

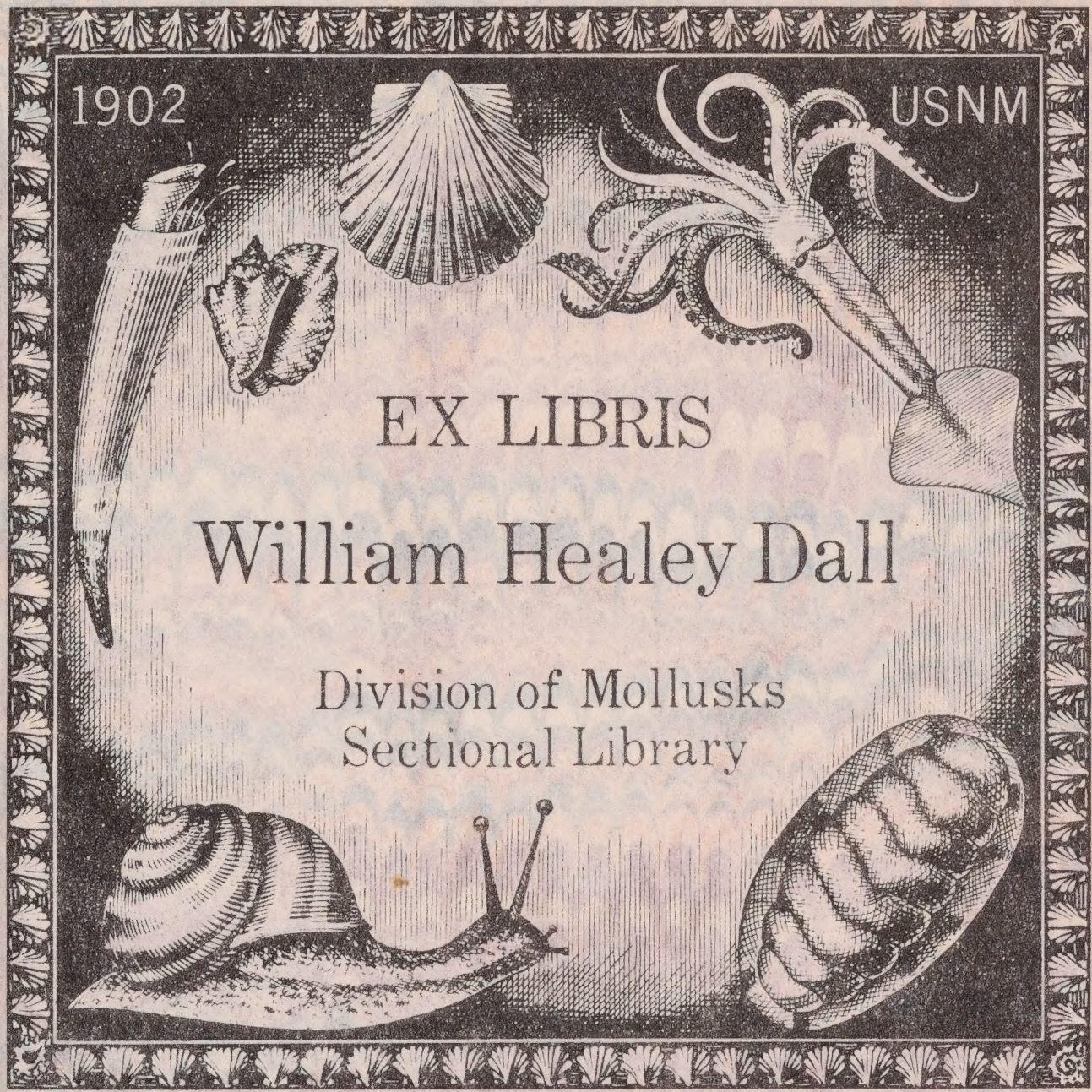
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THE
JOURNAL OF CONCHOLOGY:

BEING THE ORGAN OF THE
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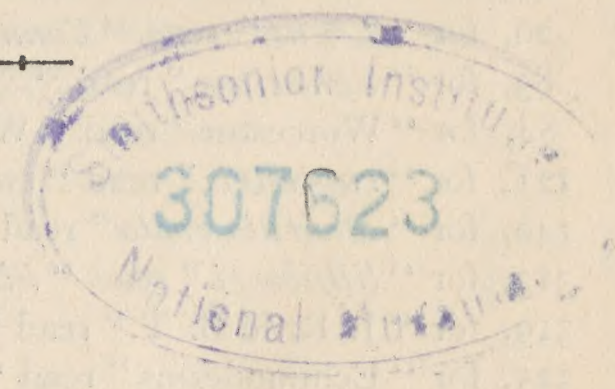
EDITED, UNDER THE DIRECTION OF THE COUNCIL,
BY

J. R. LE B. TOMLIN, M.A., F.E.S.

VOL. XVIII.

1926—1929.

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DESCRIBED IN THIS VOLUME.

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- 24, for "vlcinity" read "vicinity."
- 26, for "Lonus" read "Conus."
- 83, for "Sphærinm" read "Sphærium."
- 84, for "Worcestor" read "Worcester."
- 121, for "ruprestris" read "rupestris."
- 142, for "Decipula ovata" read "Lucina borealis."
- 313, for "lilljiborgi" read "lilljeborgi."
- 319, for "J. R. le B. T." read "W. Gyngell."
- 325, for "Echimoderms" read "Echinoderms."
- 326, line 22, for "229" read "299."
- 331, for "Contagne" read "Coutagne."
- 331, for "Crustacia" read "Crustacea."
- 332, for "Melanotenthis" (bis) read "Melanoteuthis."

THE
JOURNAL
OF
CONCHOLOGY.

FOUNDED 1874.

BEING THE ORGAN OF THE CONCHOLOGICAL SOCIETY
OF GREAT BRITAIN AND IRELAND.

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PLATE I.

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Proposed New Synonymic Check List of British Mollusca (Marine and Non-Marine).

SINCE the lists of British Mollusca were published by the Conchological Society in 1901 and 1903 a great deal of research has been done on the nomenclature of the group. Numerous papers have been published both by the Conchological Society and the Malacological Society which affect the nomenclature then adopted.

The Council of the National Museum of Wales has decided to publish a Synonymic Check List. This check list is being compiled by Mr. J. Davy Dean, F.E.S., Assistant Keeper of Zoology. In this work the co-operation of several specialists has been enlisted, notably, Mr. R. Winckworth, Mr. J. R. le B. Tomlin and Mr. Hugh Watson.

In order to make this list as complete and as up-to-date as possible it is hoped that any member of the Society who has been engaged in recent research on any genus or group will communicate the result of his research so that it may be incorporated. Communications should be addressed to the Keeper of Zoology, National Museum of Wales, Cardiff.

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1926. Millott, R. T., F.Z.S., F.E.S., Waverley Road, Mansfield.
1926. Milman, Philip Pomeroy, Cyprina, Lower Conway Road, Paignton.
1924. Mogridge, Chas. J., Ivy Cottage, West End, Fareham, Hants.
1919. Moore, Alfred A., 136, Thorpe Road, Norwich.
1902. *L* Moore, Chas. H., 103, Mottram Road, Stalybridge.
1924. Moore, Robert Charles, M.A., M.Sc., 6, Beech Grove, Beverley Road, Hull.
1923. Moore, Miss Martha Catherine, M.A., 25, Galloway Road, Waterloo, Liverpool.
1907. * Musham, J. F., F.E.S.
1911. Nash, Rev. E. H., M.A., Wetley Rocks Vicarage, Stoke-on-Trent.
1918. *L* Nevill, Rev. Ralph William, M.A., Beighton Rectory, Norwich.
1919. Nordgaard, O., Director of the Biological Station, Trondhjem, Norway.
1919. Odam, Charles Leslie, B.A., M.R.C.S., L.R.C.P., 91, Breakspeares Road, Brockley, Kent.
1923. Ökland, Fridthjof, docent, Majorstriveien 15, Oslo, Norway.
1887. *L* Oldham, Chas., F.L.S., F.Z.S., The Bollin, Shrublands Rd., Berkhamsted.
1923. Oliver, W. R. B., 26, Brandon Street, Seatoun, Wellington, N. Zealand.
1896. *L* Overton, Harry, The Newlands, Boswell Road, Sutton Coldfield.
1923. Owen, Giles, F. R. Met. Soc., 54, Townfield Lane, Barnton, Northwich, Cheshire.
1919. *L* Paton, Mrs. Brenda Jennie, Landishty, Llangattock, Vibon Avel, Nr. Monmouth.
1886. Pearce, Rev. S. Spencer, M.A., Steepleton Rectory, near Dorchester.
1921. Peile, Lt.-Col. A.J., R.A., 18, Leopold Road, Wimbledon, S.W. 19.
1913. *L* Pellow, N. E., The Homestead, Arrow, Alcester, Warwickshire.
1918. Perry, Edmund E., 6, Stuart Crescent, Wood Green, London, N. 22.
1908. Phillips, R. A., 7, Magdala Terrace, Gardiner's Hill, Cork.
1923. Prashad, Dr. B., Zoological Survey of India, Indian Museum, Calcutta.
1897. * Preston, Hugh B., F.Z.S.,
1921. Price-Jones, Cecil, M.B., The Apple Orchard, Loom Lane, Radlett, Herts.
1907. Priske, R. A. R., 9, Melbourne Avenue, West Ealing, Middlesex.
1906. *L* Pritchard, G. B., D.Sc., F.G.S., Lecturer in Zoology, School of Mines Dpt., Working-Men's College, Melbourne, Victoria.
1916. Pye, Alfred W., The Hollies, Dudley Street, Grimsby.
1916. Quick, Capt. Hamilton E., B.Sc., M.B., F.R.C.S., "Varfell," 130, Eaton Crescent, Swansea.
1906. *L* Radley, Percy E., F.R.M.S., Nesta, Station Road, Broxbourne, Herts.
1913. Rhodes, F., 113, Heaton Road, Manningham, Bradford, Yorks.
1900. Richards, C. P., Mission House, Stenalees, St. Austell, Cornwall.
1898. Roberts, A. William Rymer, The End House, 38, Fulbrook Rd., Cambridge.

1921. Robertson, Miss Jessie D., 9, Buckingham Mansions, West End Lane, N.W. 6.
1918. Robins, E. A., Gorran, Cassiobury Park Avenue, Watford.
1922. Robson, Guy C., M.A., F.Z.S., British Museum (Nat. Hist.), Cromwell Road, London, S.W. 7.
1893. Roseburgh, John, 20, Market Street, Galashiels, Selkirkshire.
1910. *L* Rowe, A. W., M.S., M.B., M.A.C.S., F.G.S., Shottendane, Margate.
1923. Rowlands, Rev. Emrys Lloyd, B.D., 40, Florence Street, Newcastle, Staffs.
1906. *L* Salisbury, Albert E., A.M.I.E.E., 12a, The Park, Ealing, W. 5.
1921. Saunders, J. H. D., 36, Warwick Avenue, Paddington, London, W. 2.
1877. *P* Scharff, Robert F., Ph.D., M.R.I.A., Knockranny, Bray, co. Wicklow.
1895. *L* Schill, C. H., Crosten Towers, Alderley Edge.
1918. *L* Schlesch, Hans, L.A.S., (Copen.), Gustav Adolfsgade 143, Copenhagen, Denmark.
1910. *L* Shaw, H. O. N., B.Sc., F.Z.S., 112 & 114, Wardour Street, London, W. 1.
1904. Shaw, Rev. W. A., Peper Harow Rectory, Godalming.
1910. Shrubsole, George, 31, Grange Road, Eastbourne.
1895. *L* Sich, Alfred, F.E.S., Corney House, Chiswick, W. 4.
1905. Simpson, James, 23, Marischal Street, Aberdeen.
1899. *L* Smith, Mrs. Lucy A., Robert's House, Siddington, Glos.
1907. Smith, Maxwell, Hartsdale, Westchester Co., New York, U.S.A.
1900. Solly, E. H., Lea Orchard, Ottinge, Elham, near Canterbury.
1917. Sowden Harry, Hon. Recorder, York and District Field Naturalists, 22, Victoria Street, Nunnery Lane, York.
1907. Spence, G. C., "Ellerslie," 48, Poplar Grove, Sale, Cheshire.
1914. Stainton, Ernest, 70, Jubilee Road, Doncaster.
1915. Steenberg, C. M., Mag. Sc., Petersborgvej, 6¹, Copenhagen.
1903. *L* Stelfox, A. W., M.R.I.A., Mayfield, 14, Clareville Road, Rathgar, Dublin.
1918. Stephens, G. A., F.L.A., City Librarian, The Public Library, Norwich.
1908. *L* Stobart, H. J. S., Belbroughton, Stourbridge.
1897. Stracey, Bernard, M.B., Châlet Dunbeg, Diemtigen, Simmenthal, Canton Bern, Switzerland.
1890. Stubbs, Arthur Goodwin, The Meads Cottage, Hailey Lane, Hertford.
1920. Sundler, Berthold, Borås, Sweden.
1895. *P* Swanton, E. W., A.L.S., The Educational Museum, Haslemere, Surrey.
1888. *P* Sykes, Ernest Ruthven, B.A., F.L.S., Lewell Lodge, Dorchester.
1925. *L* Tansley, Miss Gladys M., Wanstead House, Eastern Esplanade, Margate.
1910. Tattersall, Prof. W. M., D.Sc., Zoology Dept., University College of S. Wales, Cardiff.
1895. Taylor, Fred, 42, Landseer Street, Park Road, Oldham, Lancs.
1904. *L** Taylor, Gerald Medland.
1903. Tha anum, D., Box 2214, Honolulu, Hawaiian Islands.
1907. *L* Thornton, H. G., Kingsthorpe Hall, Northampton.
1886. *PL* Tomlin, J. R. le B., M.A., F.E.S., "Fairfield," 23, Boscobel Road, St. Leonards-on-Sea.
1906. Turton, Lt.-Col. W. H., D.S.O., R.E., 19, Caledonia Place, Clifton, Bristol.
1907. Upton, Charles, Rooksmoor, Tuffley Avenue, Gloucester.
1924. Van Benthem Jutting, Miss W. S. S., Conservator at Zoological Museum Aquarium, Plantage Middenlaan, Amsterdam, Holland.

1915. Van Hyning, T., Curator, Florida State Museum, Gainesville, Fla., U.S.A.
 1899. Vaughan, J. Williams, J.P., The Skreen, Erwood, Breconshire.
 1897. Vignal, Louis, 28, Avenue Duquesne, Paris.
 1902. Vincent, W. C. W., "Brooklands," Priests Lane, Shenfield, Essex.
 1898. Wakefield, H. Rowland, 7, Montpelier Terrace, Swansea.
 1891. Walker, Bryant, 1306, Dime Bank Building, Detroit, Michigan, U.S.A.
 1920. Ward, Arthur Wadams, Churchill, Kingham, Oxford.
 1923. Waters, Ernest Joseph Hill, B.Sc., 29, Parkdale, Wolverhampton.
 1900. *L* Watson, Hugh, M.A., Bracondale, The Avenue, Cambridge.
 1908. Weaver, G. H., 31, Devonshire Road, Palmer's Green, N.
 1900. Webb, Walter F., 202, Westminster Road, Rochester, N.Y., U.S.A.
 1902. Weeks, Wm. H., 508, Willoughby Avenue, Brooklyn, N.Y., U.S.A.
 1895. *P* Welch, Robert John, M.Sc., M.R.I.A., 49, Lonsdale Street, Belfast.
 1923. Wesley, Edward Francis, 2, Arthur St., New Oxford St., London, W.C. 2.
 1925. Wheeler, Dr. R. E. Mortimer, M.C., etc., National Museum of Wales, Cardiff.
 1915. Wilman, Miss M., McGregor Memorial Museum, Kimberley, South Africa.
 1920. *L* Winckworth, Major Harold C., R.A.M.C., 37, Upper Rock Gardens, Brighton.
 1913. *L* Winckworth, Ronald, M.A., F.R.G.S., 37, Upper Rock Gardens, Brighton.
 1921. Wincott, A. W., "Wallapoulon," Queen's Drive, Thames Ditton, Surrey.
 1917. *L* Wintle, James Benedict, F.Z.S., 30, Marlborough Road, Gunnersbury, London, W. 4.
 1898. Woods, Prof. Henry, M.A., F.R.S., F.G.S., Sedgwick Museum, Cambridge.
 1886. *L* Woodward, Bernard B., F.L.S., etc., 4, Longfield Rd., Ealing, W. 5.
 1914. Worsfold, Herbert W., 168, The Grove, Wandsworth, S.W. 18.

Limnæa pereger in swift streams.—My attention has been drawn to a slip in my recent paper on the "Mollusca in the Neighbourhood of Market Harborough."¹ In discussing the reasons for the small size of *L. pereger* living in swiftly flowing streams, the remark is made that "swift streams, by reason of their low temperature, contain less oxygen in solution than large bodies of water." Such streams are well known to be better aerated than most fresh-waters, and with increase of temperature oxygen is, of course, evolved and not absorbed. It appears possible that the low temperature of swift streams may exert a direct effect on the snails by diminishing their growth rate, and so counterbalance the advantages of superior oxygenation. This is, however, merely a suggestion, and the problem requires experimental investigation. I omitted in that paper to express my indebtedness to Mr. A. S. Kennard for examining the fossil material from near Rothwell. Mr. Kennard has since been kind enough to look over all my specimens of *Succinea "elegans"* and *Hygromia hispida* from the neighbourhood of Harborough, and has identified all the former as *S. pfeifferi* Rossmæssler, and the latter, except the fossils, as *H. liberta* (Westerlund).—A. E. ELLIS (*Read before the Society*, May 2nd, 1925).

OBITUARY NOTICE: JOHN MICHAEL WILLIAMS.

By J. WILFRID JACKSON, M.Sc., F.G.S.

(Read before the Society, April 4th, 1925).

CONCHOLOGY has lost another of its ardent students by the death of John Michael Williams, at Grove Park, Liverpool, on March 25th, 1925. Mr. Williams was in his eighty-seventh year, and his passing makes a gap in the membership of our Society which it will be difficult to fill. He was born at Holywell, Flintshire, on December 9th, 1838, and some years afterwards his parents settled in Liverpool, where he completed his education at the Liverpool Institute. On August 6th, 1864, he was married to Miss Elinor Crompton, at Balliol Road Wesleyan Church, Bootle, Liverpool, and on August 6th, 1924, Mr. and Mrs. Williams celebrated their diamond wedding.

During his association with this Church, extending for twenty-two years, he filled most offices open to laymen.

While resident in Bootle he served for some years on the Bootle School Board as the Nonconformist Representative, only retiring when an election was forced upon the ratepayers.

Always interested in Art, he studied painting purely as a hobby, giving his attention to sepia work, and beautifying his home with many examples from his brush.

For sixty-eight years Mr. Williams was engaged in the cotton trade in Liverpool. In 1886 he established the firm of Messrs. J. M. Williams & Co., from which he finally retired on December 31st, 1921, when he was elected an Honorary Member of the Liverpool Cotton Association.

For fifty years he was an active member of the Liverpool Microscopical Society, and for twenty years served as its Treasurer: in 1924 he was elected an Honorary Member of that Society.

He became a member of the Conchological Society on October 2nd, 1889, but was not a frequent attendant at the meetings during recent years. His last appearance was at the Annual Meeting, held in Manchester on October 11th, 1913, when he exhibited a number of very uncommon varieties of *Cypræa* and *Oliva*.

Mr. Williams formed a very fine collection of certain groups of exotic marine shells, his chief favourites being the above-mentioned groups, upon both of which he was a recognised authority. In these he possessed many remarkable and rare species, and several belonging to the first genus are referred to, and, in some instances, described by

Dr. J. Cosmo Melvill, in his "Survey of the genus *Cypræa* (Linn.)," 1888. In *Cypræa lynx* he possessed a magnificent specimen $3\frac{1}{4}$ " long., $1\frac{3}{4}$ " lat., together with two striking colour varieties named by Dr. Melvill: one with a bright red base (*williamsi*, Melv. 1888) and the other with a dark dorsal blotch (*michaelis*, Melv. 1905). Other forms of special interest in his collection are *C. fimbriata* var. *cholmondeleyi* Melv. (Mr. Hugh Owen's original specimens); *C. clandestina* (L.), nearly an inch in length; *C. gangrenosa* (Sol.) var. *melanosema* Melv. (fine specimens); and *C. cribraria* (L.) var. *exmouthensis* Melv. In addition there is one species of *Olivella* named after him by Melvill and Standen (*J. Conch.*, viii, 1897, pp. 380-1, text-fig.).

His magnificent series of the genus *Oliva* probably excel his Cowries, good as the latter are. A friend of Mr. F. P. Marrat, who wrote the Monograph of this genus in Sowerby's "Thesaurus Conchyliorum," he had the advantage of his living in the same city, and aiding him in this very difficult genus, famous for much intricate variation. Marrat named many species, and nearly all these were in Williams' collection. Other groups in which he specialised are *Phasianella*, *Nerita* and *Turbinidæ*.

Mr. Williams leaves a widow, three sons and five daughters, and his death is the first break in the family after sixty years. He was laid to rest in the Smithdown Road Cemetery, Liverpool, on Saturday, March 28th, with many floral tokens of respect. There was a large gathering of the family and friends at the service, and representatives of societies with which he had been connected also attended to pay a last tribute to an esteemed colleague and friend. This Society was represented by the Hon. Secretary, J. Wilfrid Jackson, and the Hon. Librarian, Edmund R. Brown.

Æstivation of *H. hortensis*.—A friend of mine whilst on holiday in Ilfracombe in August, 1924, picked up a specimen of *H. hortensis* and placed it in a match box with a small piece of Hart's Tongue Fern, placing the packet in his camera case with the intention of sending it on to me. This he forgot to do at the time and the snail slipped his memory until April 13th last, when on going to get out his camera he discovered the match box. He handed it to me on the date named and I placed it in my pocket until I reached home. On opening the box some hours later I found the snail extended and crawling round the box. The fern in the box had apparently never been touched, and as it was early in August, 1924 when the snail was boxed, it has been without food for fully eight months, and no doubt the warmth of my pocket revived it and caused it to seek nourishment. This period seems to be quite two months in excess of the usual length of æstivation for this species.—A. K. LAWSON (*Read before the Society*, May 2nd, 1925).

OBITUARY NOTICE: R. B. NEWTON.

By THE EDITOR.

[I am indebted for the following details to an article in the "Acton Gazette & West London Post" of January 29 last.—ED.]

RICHARD BULLEN NEWTON died, after an operation, on January 23rd in a nursing home at the age of 72. He was a native of Islington and both his father and uncle were on the staff of the Geological Survey.

Educated at what is now the Central Foundation School of the City of London, he joined the Geological Survey at the age of 14, when he was already showing great aptitude for scientific study, and in 1873 became an assistant naturalist under Huxley.

In 1880 he was transferred to the Geological Department of the British Museum (Natural History) and was almost at once engaged in the removal of the collections from Bloomsbury to Cromwell Road and in rearranging them in their new quarters.

In 1891 his "Systematic List of the F. E. Edwards Collection of British Oligocene and Eocene Mollusca" was published by the Trustees of the British Museum, and he also wrote many systematic reports on collections of fossils sent to the Museum for determination, mostly from Tertiary formations.

He also took up the study of Tertiary Foraminifera, as guides to the geological horizons.

In 1914 he was awarded the Wollaston Fund of the Geological Society. He was President of the Malacological Society of London in 1910-12, and of the Conchological Society in 1913-15, and for his address to the latter presented a revision of the fossils found in the Lenham Sandstones of Kent.

He was due to retire in 1914, but his keenness for his work and the outbreak of war led to his continuance in office for a further period of six years, at the close of which he was decorated with the Imperial Service Order, and granted the privilege of retaining the use of his old room for purposes of geological research. He paid his last visit there on December 31, thereby completing 57 years of public scientific work.

Up to comparatively recently he was an healthy and vigorous man and found his chief recreation in walking, usually covering about six miles a day. He was of a retiring disposition and took little part in local affairs, but he had long been a well-known member of the congregation of St. Martin's, West Acton, and was for some years president of the Marlborough Lawn Tennis Club.

He married in 1882 Miss Emilie Swonnell who survives him, and he leaves one son.

He was buried on Jan. 28 at Westminster Cemetery, Hanwell, and the mourners included Sir A. Smith Woodward and representatives of the British Museum, the Geological Survey, the Geological Society and the Malacological Society.

A CHANGE OF NAMES IN PHYSA AND ISIDORA.

BY WILLIAM J. CLENCH.

(Read before the Society, September 5th, 1925).

DURING a study of *Physidæ*, the author has noted in the literature three different species originally described as *Physa inflata*. These three species are from widely separated localities, United States, Europe and Australia. It is advisable that the names of two of these be changed, the third, *Physa inflata* Lea remaining the same, as being the first described under that name. For these preoccupied names I propose to substitute the following:—

***Physa fontinalis subflava*, new name.**

Physa fontinalis inflata Moquin-Tandon, Hist. Nat. Moll. II, p. 451, pl. xxxii, fig. 13, 1855; *non Physa inflata* Lea, Proc. Am. Phil. Soc., Vol. II, No. 17, p. 32, 1841; *non Physa inflata* Ad. and Ang., Proc. Zool. Soc., p. 39, 1864.

***Isidora newcombi hedleyi*, new name.**

Physa inflata Ad. and Ang., Proc. Zool. Soc. p. 39, 1864; *non Physa inflata* Lea, Proc. Am. Phil. Soc., Vol. II, No. 17, p. 32, 1841; *non Physa fontinalis inflata* Moquin-Tandon, Hist. Nat. Moll. II, p. 451, pl. xxxii, fig. 13, 1855.

Occurrence of *Helix aspersa* on Granite.—In the summer of 1919, I spent a few days at Pwllheli and neighbourhood, but as the season was very dry, little could be done in the way of collecting landshells. The general character too of the soil is not very well suited for mollusca, as it is largely composed of slates and shales. At the extreme end of the right bank of the river flowing from the 'Pool,' there is an outcrop of granite and one day to my astonishment I found there a colony of *Candidula caperata*. Further search in the vicinity revealed a few *Helix aspersa*. Not wishing to disturb the colony of the latter, I looked round until a dead shell was found, and the living ones were left. As this is the first and only time that I have found *Helix aspersa* actually living upon granite, I shall be pleased to learn if others have had a similar experience.—C. H. MOORE (Read before the Society, February 4th, 1925).

NOTES ON BRITISH MOLLUSCA—I.

By R. WINCKWORTH, M.A., F.R.G.S.

(Read before the Society, January 6th, 1926).

Solenogastres.

This group was included in the 1902 list under the name *Aplacophora* as a suborder of the *Amphineura*. The researches of Odhner, 1921 (in Bergens Museums Aarbok for 1918-19) shew that their relations are rather with Archiannelids than with Molluscs, and that they must be allotted a position among the Scolecids as a group co-ordinate with Platyhelminthes, Nemathelminthes and Nemertines. In lacking a foot, mantle and mantle cavity with ctenidia, they are essentially different from mollusca; the nervous system shews little relationship to that of Chitons, while the radula and calcareous plates are not homologous with the molluscan radula and shell. For descriptions and figures of the five recorded British species, see Garstang, "British Aplacophora," in Proc. Malac. Soc. ii, 1896, p. 123. The whole group is reviewed systematically by Thiele, 1913, in "Das Tierreich." Heath, 1911, in Mem. Mus. Comp. Zool. Harvard, vol. xlv. gives a complete bibliography.

Placophora.

In the following list I have followed the classification given by Thiele, "Revision des Systems der Chitonen" in Zoologica, Heft 56, Stuttgart, 1909-10.

Family LEPIDOPLEURIDÆ.

Genus LEPIDOPLEURUS Risso, 1826. Type: *Chiton cajetanus*, Poli, subsequent designation by Gray, 1847.

L. asellus (Gmelin), 1791. Type locality, Norway. Gmelin's species is based on Chemnitz, who gives a poor figure and description of an example from the Spengler collection. Spengler again described *Chiton asellus* in 1797, and another form of this variable species as *Chiton onyx*; the latter is in some respects intermediate between *asellus* and the far northern race *arcticus* Sars, 1878. Jeffreys gives *Chiton rissoi* Payreaudeau as a variety of this species, which he calls *cinereus*; but *rissoi* is a quite distinct Mediterranean species. As a name, *Chiton minimus* has page precedence over *asellus*, and has been referred to this species by some, but the earlier description is unrecognisable and the later description by Spengler indicates a young *Tonicella rubra*.

L. alveolus (Loven), 1846. This may prove British as well as Norwegian, since it has been recorded from deep water in the Bay of Biscay.

L. scabridus (Jeffreys), 1880. A common Channel Island Chiton, also recorded from Torbay.

L. cancellatus (Sowerby), 1839.

Genus HANLEYA Gray, 1857. Type: *H. debilis*, Gray (= *hanleyi*), monotype.

H. hanleyi (Bean), 1844. Type locality, Scarborough, low water, presumably brought in by fishing boats from deeper water. *Chiton mendicarius* Mighels, 1843, from Casco Bay is apparently a distinct species.

H. abyssorum (Sars), 1878. I have seen a British specimen from the Rockall Bank.

Family LEPIDOCHITONIDÆ

Genus LEPIDOCHITONA Gray, 1821. Type: *Chiton marginatus* Pennant [= *cinereus* L. non Jeffreys], monotype. On this genus name and *Acanthochitona*, see Iredale, Proc. Malac. Soc. xi, 1914, p. 126. The names must be treated as masculine, though why Gray formed these words in the accusative is not clear. Synonyms: *Craspedochilus* Sars, 1878 (same type); *Trachydermon* Carpenter, 1863 (type: *flectens* Cpr.).

L. cinereus (Linné), 1767. Type locality, Norway; the identification is based on the specimens in the Linnéan cabinet.

Genus TONICELLA Carpenter, 1873. Type: *Chiton marmoreus* Fabricius. Synonyms: *Boreochiton* Sars, 1878; *Toniciella* Dautzenberg and Fischer, 1912.

T. marmorea (Fabricius), 1780. Type locality, Greenland.

T. rubra (Linné), 1767. I do not think Jeffreys' variety *oblonga* need be retained; his figures give 1.86 and 1.82 for the ratio of length to breadth in variety and species.

Genus CALLOCHITON Gray, 1847. Type: *C. lævis* Montagu, original designation.

C. achatinus (Brown), 1827. Type locality, Newhaven, Midlothian. The more familiar name *C. lævis* Montagu cannot be used, as there is the earlier *C. lævis* Pennant, which is probably *Tonicella rubra*, though the wretched figure cannot be certainly identified, and the types are not to be found in the Pennant collection. Brown's figures are quite unmistakable.

Family CRYPTOCONCHIDÆ

Genus ACANTHOCHITONA Gray, 1821. Type: *Chiton fascicularis* Linné, monotype. Synonyms: *Acanthochites* Risso, *Acanthochætes* Leach, *Acanthochiton* Fischer, *Phakellopleura* Guilding. Unfortunately the species of this genus have been much confused, and the result is

a muddle which can only be cleared by using unfamiliar names for two of our species, and a familiar name in an unfamiliar sense for the other.

A. crinitus (Pennant), 1777. Type locality, Aberdeen. Although the type specimen is not to be found, this species can be safely identified as *fascicularis* of Forbes and Hanley and most authors from the locality and small figure; the magnified figure is not good, but that is the result of the distortion of the magnifying glasses of those days. *Chiton fascicularis* Linné is described as from Algiers, and is, therefore, probably *discrepans* auct. non Brown, but as no type specimen exists, the identity of the species is uncertain.

A. discrepans Brown, 1827. Type locality, Tenby. This from locality and figure is certainly the same as *Chiton gracilis* Jeffreys, 1859. Monterosato suggests the latter to be also *A. æneus* Risso, 1826, but the description given by Risso does not fit our chiton, and Risso's collection was left in such disorder that the fixing of type specimens is hardly possible.

A. communis Risso, 1826. Type locality, Nice. Brief as the description is I think this may certainly be taken as the species usually called *discrepans*.

Thus we have the following synonymy for the three British species: *crinitus* Pennant = *fascicularis* Jeffreys non Linné = *vulgaris* Leach. *discrepans* Brown = *gracilis* Jeffreys = *æneus* Monterosato, ? Risso. *communis* Risso = *discrepans* Jeffreys non Brown = ? *fascicularis* L.

Family ISCHNOCHITONIDÆ.

Genus ISCHNOCHITON Gray, 1847. Type: *Chiton textilis* Gray, original designation. As the isolated group of *albus* Linné shews a marked difference from typical Ischnochitons of warmer latitudes, especially in the superficial resemblance to *Lepidopleurus* and in the radula, it seems well to place it in a separate sub-genus. To avoid coining a new name, I will revive Middendorff's *Stenosemus*, selecting as type the species *albus*.

I. (Stenosemus) albus (Linné), 1767. Type locality, Iceland. The Scotch examples seem to me to differ somewhat from more northern ones, and the race name *aselloides* Lowe, 1825, is available for British forms.



BRITISH MARINE MOLLUSCA: CENSUS.

By R. WINCKWORTH, M.A., F.R.G.S.

(Read before the Society, Jan. 6th, 1926).

ALL members of the Conchological Society are invited to give their co-operation in recording the distribution of British Marine Mollusca. The help of all collectors is wanted and is cordially and earnestly solicited. While any specimens will be examined by the Recorder if requested, it is proposed at present to work through the mollusca, group by group, not necessarily in systematic order, and review the distribution and nomenclature of each group successively.

Specimens sent for record should be addressed to R. Winckworth, 37, Upper Rock Gardens, Brighton. Specimens will be returned at the sender's request, if stamps for return postage are enclosed; specimens that are not required back will be gratefully added to the Society's collection.

After full consideration, it has been decided to record only those specimens that have been taken living; a record list is only of value if it is reliable, and a large proportion of erroneous localities is due to the recording of shells which have not been taken living; there are so many possibilities by which apparently fresh shells can be transported to new and distant localities. One may instance alleged British records of *Lima excavata* (F.), *Arca pulchella* Reeve, *Tricolia speciosa* (Megerle), *Cypræa moneta* L. among hundreds of such records; while pleistocene shells are often dredged and sometimes recorded as recent.

In addition to the *exact locality* where the species was found *living*, further information as to whether it was observed singly, sparingly or in abundance, in what zone of the shore it was taken, or at what depth and on what bottom it was dredged, etc., would be of value; and especially notes of associated plant or animal life, and any details bearing on its life history. The date of collecting is also often of importance.

Census Areas.—Until revision seems necessary, the scheme proposed in this Journal, vol. xvi, p. 152 (1921) will be adopted, with the exclusion of area vii, Channel Isles, which biologically is certainly French rather than British. In littoral and sublittoral records, the locality or county will usually be quoted in addition to the area, so that, e.g., it will at once be possible to separate Welsh and English records in area ix if required.

Nomenclature.—The Recorder proposes to use this opportunity to revise the nomenclature of British Marine Mollusca; no complete list has appeared since those of 1901 (Step) and 1902 (Chaster and others). Since then the literature has been so fully examined, and so much new work has been done on various groups, that it should be possible to make a nearer approach to a standard reference list. In this connexion I will quote Dr. Dall (Smithsonian Institution, Bulletin 112, 1921, p. 3); "The international rules of nomenclature have been rigidly followed, in the belief that the progress of science depends largely on standardisation of names, however painful it is to note the disappearance of familiar but erroneous designations. The accuracy called for by the present state of the science should not be relaxed to satisfy the protests of amateurs in taxonomy." Criticism of nomenclature and taxonomy will always be welcome from those who have made special study of the literature or anatomy of any group. I should like here to acknowledge the very numerous suggestions and great help given me by Mr. Tomlin on many occasions, and to record my appreciation of the work Mr. Davy Dean is doing on this subject at the National Museum of Wales.

Chitons wanted.—During the next three months, I am appealing specially for chitons for record. Notes on this group appear on pages 13 and 21 of this number.

Paludestrina jenkinsi in Pembrokeshire.—This determined colonist has now invaded at least one of the islands off the Pembrokeshire coast. In July 1925 I found it on rock-girt Skokholm, where it was living, in its usual abundance, underneath stones in tiny trickles of water on the cliffs, in just such places as I am accustomed to find *Ancylus fluviatilis* and *Vertigo antivertigo* on sea cliffs in Anglesey and Carnarvonshire. I was unable to visit Skomer, and despite a diligent search was unable to find it on Ramsey, but on St. David's Head and between Newgale and Solva it was living under stones in the little trickles on the cliffs. It abounded in the Western Cleddy above Haverfordwest.—CHAS. OLDHAM (*Read before the Society*, December 2nd, 1925).

Cæcilioides acicula (Müll.) in an unusual locality.—On April 21st last I spent a short time collecting on Hall Road Sandhills (S. Lancs.). At one spot, close to the sea, some garden and builders' rubbish was tipped about three years ago. This is now buried in sand and grass roots. On unearthing some slates at a depth of about eight inches, I came across a living specimen of *C. acicula*, about half grown. This species has not been recorded for South Lancashire and I imagine that it is not often found on sandhills. Yet it must have persisted and propagated itself in this locality for at least three years. Doubtless the lime among the builders' rubbish suited it, as it suits *Vallonia costata* (Müll.) in the same locality. The specimen has been verified by the Society's referees.—L. W. GRENSTED (*Read before the Society*, Sept. 5th, 1925).

THE GENUS PUPILLA IN THE UPPER DISTRICT OF THE RIVER VISKAN.

By BERTHOLD SUNDLER.

Read before the Society, February 4th, 1925).

IN the course of continued studies of the land and freshwater shells in the district surrounding the sources of this river and its superior valley I have found some rare species of the genus *Pupilla*. It is my intention to give below a brief account of the species of this genus which are found there.

The landscape is in its eastern parts, where the sources of the Viskan are, rather flat, but a little way farther to the west, especially in the surroundings of Boras, it becomes intersected with hills and valleys. The mountains are here and there very rugged and descend abruptly. They are generally covered with spruce forests, but leafy wood consisting of birches, oaks, linden-trees and hazel is frequent. As the slopes under the cliffs are covered with linden-trees or hazel bushes, there is a good locality for shells, and many different species occur there too, but nowhere do they occur in abundance. This is particularly the case with the small *Pupilla* species, which are rather scanty. This may be due to the fact that the soil is generally very little calcareous, which is not favourable for the development of the molluscs.

Pupilla muscorum Linné generally occurs on walls shadowed by trees and on lawns in gardens. It appears to be a species of cultivation and has never been found by me on ground not cultivated.

P. muscorum Linné f. ***unidentata*** C. Pfeiffer occurs scantily among the main species.

Vertigo pygmæa Draparnaud has been found by me only in one place, Rangedala, at a pond through which flows a small river. Some years ago it occurred very scantily, but these last two summers I have looked for it in vain; probably it has disappeared altogether.

V. substriata Jeffreys occurs scantily on the mountain slopes under linden-trees and hazel bushes among mouldering leaves and twigs.

V. antivertigo Draparnaud.—This shell has been found in single specimens here and there in watery and moist regions. A great many small moss-lakes surrounded with *Carex* and *Sphagnum* vegetation occur, but the shell is never found there. Some years ago it occurred abundantly in the Rangedala district mentioned above together with *Vertigo pygmæa*, but now it has decreased so much in number, that

in places where previously I could gather in a little while 50 specimens or more this summer I could hardly gather any. The district being a narrow meadow, on one side limited by the pond and the small river and on the other side by the high-road, offers the same character as formerly, but may have been at times inundated on account of the continual rains of these last summers. The eight-toothed variety is the most common one, but the nine-toothed occurs too, and the seven-toothed is very scanty.

V. lilljeborgi Westerlund.—In *Journal of Conchology*, 1924, no. 4, I have given an account of the occurrence of this species in the mollusc-fauna which has invaded the ancient lake-bottoms of the Varnum lakes after the lowering of the levels of these lakes in 1881. I found the shell there in August, 1923, when it occurred very scantily on the swampy meadows together with *V. antivertigo*. Some days later there came a heavy shower. On visiting the district a week later I found it was altogether changed into a lake of half-a-metre's depth. It went on raining the whole autumn, so the water rose still more, and the lakes, whose levels had been lowered, again covered their former area. Accordingly I visited the district in 1924 with a curiosity, easily explained, to see whether the shells had been able to survive the inundation. The water now had mostly sunk down to its original low level, but this summer has been wet too, and I had to wade into the water to examine tufts rising in the lake. I made two different excursions there and worked with the sieve for several hours every time. The result was that I found a living specimen sitting on the stake of a wattle fence. Accordingly I may cherish the hope that the species is not extinct and that it has been able to survive in spite of adverse circumstances.

This specimen offers a peculiarity in having, though fully developed, only one palatal tooth. Thus it is three-toothed according to the formula 1-1-1. As I have shown in my previous article, the species there occurs in a four-toothed and a five-toothed variety. Hence we may conclude that *V. lilljeborgi* is subject to the same variations with regard to the teeth as some of the "many-toothed" *Vertigo* species.

V. ronnebyensis Westerlund.—Of this rare shell I have found some isolated specimens in a mountain ridge, Rya asar, north-west of Borås. It occurs just under a cliff on black soil which is sparsely covered with birch, oak and linden, among mouldering leaves. Contrary to all my expectations I found it, however, in the autumn of 1924, when using my sweep-net in whortleberry (*Myrtillus nigra*) and red whortleberry shrubs (*Vaccinium vitis-idaea*) in a place not far from the other together with *Sphyradium edentulum* and *Acanthinula*

harpa. What struck me was the fact that as early as the summer of 1917 I had visited the spot several times every year from the early beginning of spring till end of autumn. On these visits I have tried for *A. harpa* and *S. edentulum* with my sweep-net without finding *V. ronnebyensis* until this year. The species invariably occurs four-toothed, often dark yellow-brown.

V. alpestris Alder occurs in the same places as *Pupilla muscorum* on walls overshadowed by old trees, and moreover sparsely here and there on black ground under perpendicular cliffs in mouldering leaves.

V. arctica Wallenberg occurs on only one spot, about 10 km. north of Borås, partly in an unusually abundant vegetation, partly in whortleberry shrubs. Only some few isolated specimens have been found. Its occurrence is very peculiar, as its geographical range does not begin till 15 degree of latitude farther to the north. However, it has been found on one more spot in Sweden in the same southern degree of latitude. Like some other species, *Sphyradium columella* and *Acanthinula harpa*, which occur here, it must be considered as a relic from a period when the climate was much colder than it is nowadays.

As a rule it occurs three-toothed, but still a specimen with only two teeth has been found, the parietal tooth lacking, which is striking, since, as a rule, this tooth is the strongest, and one specimen with four teeth, *i.e.*, with two palatal teeth, which case is probably unique.

V. pusilla Müller occurs on several spots in mountain slopes under hazel and linden, but everywhere scanty. As a rule it is six-toothed, but sometimes it is seven-toothed too.

In this account of the genus *Pupilla* I also include the subgenus *Sphyradium*, which was formerly brought to this category, but now is classified with the genus *Helix*.

Sphyradium edentulum Draparnaud is the most common of the species enumerated here. It occurs abundantly in whortleberry and red whortleberry shrubs, further in grass, moss and mouldering leaves.

S. edentulum Draparnaud var. **turritella** Westerlund is found scantily together with the main species, being not very different from it. It appears rather doubtful whether it should be considered a special subspecies.

S. columella Westerlund occurs scantily on several of the ranges of the previous species, from which it is not much distinguished. Westerlund states the southern limit of its geographical range as the 61st degree of latitude. Since this district lies south of the 58th degree of latitude, the species, as was said above, must here be looked upon as a relic from a period with colder climate.

THE NOMENCLATURE OF CERTAIN BRITISH MOLLUSCA
AND DESCRIPTION OF A NEW SPECIES OF
EMARGINULA.

By J. DAVY DEAN, F.E.S.

(Read before the Society, January 6th, 1926).

PLATE I.

CLASS AMPHINEURA.

FAMILY CRYPTOCONCHIDÆ.

GENUS ACANTHOCHITONA Gray, 1821.

A. communis (Risso) 1826 = **discrepans** auct.

It is necessary first to mention that the well-known Channel Island and south coast Chiton, identified by most authors as *discrepans* Brown, was described by Risso as above: that is, previous to Brown.

A. discrepans (Brown) 1827 = **gracilis** Jeffreys. Type locality, Tenby. Figures 1 to 1d.

I do not think Brown ever intended his description to refer to the shell with which most authors have associated it. His figure has been criticized and his locality questioned.

A. discrepans (Brown), as at present understood, has not so far been recorded from Tenby. There are, however, in the National Museum of Wales, specimens from Tenby collected more than fifty years ago, which are not the *discrepans* auct. but what is known as the var. *gracilis* Jeff. of *fascicularis* auct. (N.M.W. 16.174.10.). Whether they are duplicates collected by George Lyons or not it is impossible to determine, but they come very near Brown's original figure—"Illustrations of the recent Conchology of Great Britain and Ireland," Plate XXI, figure 20—and can here be compared: figures 1, 1a—and contrasted: figure 2.

The above was brought to my notice some little time ago by Mr. R. Winckworth, and on receiving his notes I made a dissection of a shell which I considered most typical. This is one of a small series from Weymouth, belonging to the collection above-mentioned (N.M.W. 16.170.9.).

There is also a fine specimen marked *gracilis* in Dr. Chaster's collection, the set from Tenby as mentioned above—labelled *discrepans*, and a further series from Tenby from the Bartlett Span Collection labelled *fascicularis* L.—some rightly named, three others being *gracilis* Jeff.

Jeffreys first described *Chiton gracilis* in the Ann. Nat. Hist., Feb. 1859. There is an excellent figure in Sowerby's "Illustrated Index of British Shells," Plate X, fig. 6, published in the same year. It is

the greatest pity that Brown's shell has been misunderstood, for it stands quite apart from either *fascicularis* auct. or *communis* Risso by the shape of the valves alone, figures 1b. to 1d; 2a. to 3c.

In size it is intermediate between the two last-mentioned species. It may be helpful to give Mr. Winckworth's excellent analysis:—

Acanthochitona gracilis (Jeffreys).

Distinguished by

- (a) the very broad girdle.
- (b) the extra tuft which is always present; even in badly worn specimens the pocket may be made out.
- (c) the compact granular sculpture of the valves.
- (d) the size of the individual tubercles, larger than in *communis*, smaller than in *fascicularis*.
- (e) the shape of the valves.

CLASS GASTROPODA.

FAMILY FISSURELLIDÆ.

GENUS DIODORA Gray, 1821 = *Glyphis* Carpenter 1856.

Reference here should be made to Tryon's Manual of Conchology Vol. XII, p. 203, 1890, that is, more than ten years *before* the publication of the last British list, and to Iredale's note on *Diodora*, Proc. Malac. Soc. Vol. XI, p. 331.

Diodora apertura Montagu, 1803 = **Fissurella græca** auct. non L.

Pilsbry says "The young *Glyphis* (3-4 mm. in length) has a recurved spiral apex with the fissure in front of it, exactly as in *Rimula*. The truncation and pit back of the hole-callus are homologous with the septum and pit back of the hole in *Puncturella*; a fact not heretofore noticed."

Pilsbry does not, however, figure the young stage, so perhaps it may be of interest to give both a copy of Montagu's figure in "Testacea Britannica" Plate XIII, fig. 10, and a drawing of a shell from Milford Haven, 8 mm. long, still showing the recurved apex (N.M.W. 16.174.18.), figures 4, 4a.

GENUS EMARGINULA Lamarck, 1801.

Emarginula anassa* sp. nov. (Figures 7 to 7b).

This is the shell which has so long been identified with the Crag fossil *Emarginula crassa* J. Sowerby.

Reference should also be made to "The Pliocene Mollusca of Great Britain," by F. W. Harmer.

**ἄνασσα* = queen.

Here the British species are :—

Emarginula crassa J. Sowerby.

Emarginula crassalta S. V. Wood and var. *conica* Wood.

Emarginula fissura Linné and var. *depressa* Harmer.

Emarginula elongata O. G. Costa.

Emarginula rosea T. Bell.

These are all recorded occurring in a recent form on the British coasts with the exception of *elongata*, which is more southern. It is with the first two that these notes have to deal. *E. crassalta* is distinguished from *crassa* by its much more conical form and by its sculpture: by the “stronger, sharper and closely set ribs,” though Harmer remarks that this distinctive character has not been generally recognised. But it seems to me, from the figures and dimensions given, that while the length and breadth in *E. crassalta* are somewhat nearer the recent form the altitude is not: there is little or no hook and, even allowing for a worn specimen, its position, together with the *convex posterior slope*, suggests an entirely different shell. Close examination of the slit, sculpture and general proportions of *E. crassa* reveal also several discrepancies between recent shells from Oban and specimens of that species from the Crag at Sutton and Bawdsey (N.M.W. 13.149. G.4. and 20.33. G.378), besides the striking difference in size, contour and proportions. In both fossil forms the slit is broader, shorter, and truncate at its junction with the groove above: see figures 5 to 5b. (*crassa*): 6 (*crassalta*).

RECENT DISTRIBUTION:—Bodö in Norway to Dublin and the Anglesey coast (P.Z.S. 1882, p. 678: Jeffreys).

DESCRIPTION:—Shell white, moderately solid, opaque, slightly glossy; sculpture, numerous longitudinal ribs, unequal, sometimes grouped or paired, between which are fine longitudinal striæ, the whole crossed by fairly regular concentric lines of growth and striæ, giving in young specimens a beaded appearance; shell shorter in proportion to its breadth than in *crassa*, with its greatest width *above the apex*, more oval in contour and a much greater proportionate height; margin scalloped, lip fine, irregular; hook produced, overhanging the posterior slope which is at first straight and rarely convex; slit narrower and deeper than in *crassa* or *crassalta*, sometimes even in young specimens deflected to the right or left, groove continuous to the apex; base of groove curved, sometimes lamellated.

Proportions of shell compared in millimetres :

E. anassa L.21. B.16. H. 9—Oban ; type specimen.

L.32. B.24. H.16—Oban ; Coll. Chaster.

E. crassa L.41. B.29. H.17—Red Crag, Sutton.

E. crassalta L.36-45. B.28-32. H.25—Vide Harmer.

Type of **anassa** in National Museum of Wales (N.M.W. 16.174.19.) Loc. Oban.

Also two, Loc. Oban (N.M.W. 15.237.25.).

Also from Oban (N.M.W. 10.29.53.) Chaster Collection, five, showing growth stages.

EXPLANATION OF PLATE I.

1. *Acanthochitona gracilis* Jeff.—Tenby, Pem.
- 1a. *Chiton discrepans* (= *gracilis*) : after Brown (shading reversed).
- 1b. *Acanthochitona gracilis* : posterior valve $\times 3$.
- 1c. " " median " "
- 1d. " " anterior " "
2. *Acanthochitona discrepans* auct. = *communis* Risso.
- 2a. *Acanthochitona communis* : posterior valve $\times 3$.
- 2b. " " median " "
- 2c. " " anterior " "
- 3a. *Acanthochitona fascicularis* auct. : posterior valve $\times 3$.
- 3b. " " " median " "
- 3c. " " " anterior " "
4. *Patella apertura* Montagu, after Montagu.
- 4a. *Diodora apertura* (Mont.)—Milford Haven, Pem. $\times 2$.
5. *Emarginula crassa*, J. Sowerby—Pliocene, Sutton, Suffolk.
- 5a. " " " " " (outline).
- 5b. " " " " " showing sculpture and slit (enlarged).
6. *Emarginula crassalta*, Wood—Bawdsey, Suffolk, showing sculpture and slit (enlarged).
7. *Emarginula anassa* sp. nov.—Oban : type specimen $\times \frac{4}{3}$.
- 7a. " " " " " (outline) "
- 7b. " " " " " showing sculpture and slit (enlarged).

Except where marked figures are natural size.

Clausilia bidentata var. **albina** on the Firth of Clyde.—In July, 1923, we spent a short holiday on the Firth of Clyde, between Helensburgh and Row in the Gareloch. Directly opposite where we were staying in Ardencaple Road was a moss-covered garden wall, on which *Clausilia bidentata* was very plentiful; my son noticed a var. *albina* the first evening, and subsequently we obtained three more during our fortnight's stay. On going to the same place in August, 1924, we obtained three more during our three weeks' stay; this year, 1925, we were not successful in finding any; we only spent about twenty minutes at the place, as we were staying in Glasgow. All the seven specimens were found in a very restricted area, not more than twenty feet in length, although the type was common the whole length of some two hundred yards of the wall. All the walls in the vicinity of the Gareloch are moss-covered and abound with *C. bidentata*.—F. RHODES (*Read before the Society*, November 4th, 1925).

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND.

538th Meeting, held at the Manchester Museum, May 2nd, 1925.

Mr. G. C. Spence in the chair.

Donations to Library announced and thanks voted :

"The South African species of the molluscan genus *Onchidella*," by Hugh Watson (from the author).

"The Non-Marine Mollusca of Portuguese East Africa," by Major M. Connolly (from Hugh Watson).

"Studies in Ampullaria," by E. G. Alderson (from the author).

Dr. W. D. Lang. Dr. D. P. Blair. R. Garnett.

W. R. Eastwood.

Member Struck Off.

The name of a certain member was read out as having been struck off the List in accordance with Rule IV, in consequence of the non-payment of arrears of his subscription.

Papers Read.

"Annual Report (1924) of the Yorkshire Branch," by J. Digby Firth.

"Aestivation of *H. hortensis*," by A. K. Lawson.

"*Limnæa pereger* in swift streams," by A. E. Ellis.

"Mollusca from the Belgian Congo (IV)," by G. C. Spence.

"On a Collection of Non-Marine Mollusca from the Mascarene Islands," by Major M. Connolly.

"Albinism in European Clausiliidæ," by J. R. le B. Tomlin.

Exhibits.

By Mr. A. K. Lawson :—*H. hortensis* (alive) to illustrate his note.

By Mr. G. C. Spence :—A large series of Congo Mollusca, collected by Mr. F. M. Dyke, to illustrate his paper.

By Mr. W. H. Heathcote :—*Orthalicus undatus* Brug. (alive) found at Preston on bananas from Jamaica ; also a series of specimens obtained by crossing various species of *Limnæa*.

By Mr. J. W. Jackson :—A large example of *Cardium pseudolima* Lam., comparable in size with Reeve's figure 4, plate I, in *Conchologia Iconica*, vol. II.

By Mr. E. R. Brown :—Colour forms of *Oliva irisans* Lam., *O. inflata* Lam., and *O. ponderosa* Gmel.

The Special Exhibit was São Thomé Shells.

539th Meeting, held at the Manchester Museum, September 5th, 1925.

Mr. G. C. Spence in the chair.

Miss Gladys M. Tansley, Wanstead House, Eastern Esplanade, Margate (introduced by Dr. Arthur Rowe and J. W. Jackson).

Resignation.

Mrs. Jessie M. Blundell.

Papers Read.

"A Change of Names in *Physa* and *Isidora*," by William J. Clench.

"*Cæcilioides acicula* (Müll.) in an unusual locality," by Rev. L. W. Grensted.

Exhibits.

By Mr. A. E. Ellis :—Caddis cases from Malling Marsh, near Lewes, composed of fragments of weeds and the shells of *Sphærium corneum*, *Planorbis vorticulus*, *P. vortex*, *P. contortus*, etc.

By Mr. C. J. Mogridge:—A reversed *Helix aspersa* from Fareham, Hants. ; also interesting varietal forms of several foreign marine species, including *Mitra episcopalis* (of dark purple colour), *Lonus miles* (with rather produced spire), a small white *Harpa*, and two abnormal *Cypræa arabica*.

By Mrs. Gill:—Species of *Umbraculum* and *Dolabella*.

By Mr. E. R. Brown:—An interesting series of colour forms of the larger species of *Oliva*.

By Mr. G. C. Spence:—Series of shells from Portuguese East Africa.

540th (Annual) Meeting, held at the Leeds City Museum, October 24th, 1925.

The President, Mr. Henry Crowther, F.R.M.S., F.Z.S., in the chair.

The following were present:—Messrs. J. Digby Firth, Fred Rhodes, E. E. Gregory, J. A. Hargreaves, W. Moffat, W. H. Heathcote, J. W. Taylor, A. W. Edge, H. Sowden, B. R. Lucas, A. K. Lawson, T. W. Saunders, Fred Taylor, J. Davy Dean, Chas. Oldham, J. H. Lumb, Thos. Castle, H. C. Versey, Greevz Fysher, E. Hawkesworth, J. R. Dibb, W. D. Hincks, M. J. Stewart, G. C. Spence, W. Gyngell, Dr. A. E. Boycott, Mr. and Mrs. C. H. Moore, Mr. and Mrs. Wilfrid Jackson, Miss Alicia Standen Jackson, Master Robert Standen Jackson, and Miss Crowther.

Appointment of Scrutineers.

Messrs. F. Taylor and F. Rhodes were appointed Scrutineers.

Appointment of Auditors.

Messrs. C. H. Moore and G. Owen were re-appointed Auditors.

Candidates Proposed for Membership.

F. W. Fierke, 86, Grafton Street, Hull.

Francis E. Atkinson, M.R.C.S., Medical Officer of Health, "Bowerley," Settle.

New Member Elected.

Miss Gladys M. Tansley.

Election of Honorary Member.

On the nomination of the Council, and on the motion of J. Wilfrid Jackson, seconded by J. Davy Dean, and supported by several members, Dr. William Evans Hoyle, M.A., was unanimously elected an Honorary Member of the Society.

Presidential Address.

The President delivered an Address on "Some Conchological Byways," illustrated with beautifully coloured lantern slides.

A cordial vote of thanks was passed to the retiring President for his interesting address.

Votes of thanks were also accorded to the authorities of the Manchester Museum for the use of rooms for the monthly meetings of the Society, and to the authorities of the Leeds City Museum for the use of rooms for the Annual Meeting.

Election of Officers and Council.

The Scrutineers reported that the Officers and Council for 1925-26, as nominated by the Council, had been unanimously elected (see page 1).

Exhibits.

By the President:—Series of specimens to illustrate points in his address.

By the Leeds City Museum:—"The Ashworth Collection of British Shells," and "The Atkinson Memorial Collection of Shells." The galleries were also thrown open to the members.

By Mr. J. W. Taylor :—Portraits of Conchologists (vols. i and ii), with Notes of the notable events of their lives, and their Autographs. *Planorbis corneus* and its variations evolved on mendelian principles (bred and reared by Chas. Oldham).

By Mr. Fred Rhodes :—*Clausilia bidentata* and var. *albina* from Ardencaple Road, Helensburgh, Dumbartonshire ; *Clausilia cravenensis* from many localities, and mon. *dextrorsum* from Ingleton, Yorks. ; 12 woodcuts of British Unionidæ, by Joseph Wilcock, of Wakefield (1885-8).

By Mr. J. Davy Dean :—Dextral and sinistral species of *Albinaria* from Greece and Crete.

By Mr. G. C. Spence :—Land Shells from Jamaica.

By Mr. A. K. Lawson :—*Limnæa stagnalis* from an over-crowded pond at Ashley Mill, Cheshire, shewing variation over a period of six years.

By Mr. J. H. Lumb :—English and foreign species of *Succinea*.

By Mr. C. Oldham (for A. W. Stelfox) :—*Helicodonta obvoluta*, bred specimens (4th generation), from examples obtained at Bignor, West Sussex, Sept. 1911.

By Mr. J. W. Jackson :—MS. work, entitled : “The Elements of Conchology,” compiled in 1826, by John Atkinson, of Bowdon, Cheshire. The work contains a description and some criticism of the “Swainson Collection,” bought by the Manchester Natural History Society.

ANNUAL REPORT.

THE present is the Forty-Ninth Annual Report of the Society. At the last Annual Meeting the membership was 274. Since then the Society has lost three members by resignation, five by death, and five have been struck off the roll of members in accordance with Rule IV, making a total loss of 13. Eleven new members have been elected, the membership now being 272. The Council hopes that there will be a much greater influx of new members during the next year in order to fill the gaps in the membership roll.

The losses to the Society by death are G. K. Gude, a member since 1890 and a well-known authority on tropical land mollusca (see *Nature*, Nov, 22, 1924, p. 760 ; and *Proc. Malac. Soc.*, XVI, July 1925, p. 203) ; Maurice Cossmann, an Hon. Member of the Society and famed for his researches on the Eocene Mollusca of the Paris Basin (see Obituary in *Quart. Journ. Geol. Soc.* LXXXI, pt. 2, 1925, p. XLIX ; also *Proc. Malac. Soc.*, XVI, pt. 5, July 1925, p. 203) ; W. H. Whitelock ; Robert Standen, a Past President and Hon. Member of the Society and serving for some years as Hon. Secretary of the former Manchester Branch and later Hon. Curator of the Society (Obituary in this Journal, July 1925, p. 225) ; and J. M. Williams, a member since 1889 and well-known for his large and exquisite collections of *Cypræa* and *Oliva* (an Obituary will appear shortly).

The usual monthly meetings have been held at the Manchester Museum (by the continued kind permission of the authorities) and the attendance has been well maintained. Twenty-six notes and papers have been read and some of these have already been published in the Journal. Six Special Exhibits have been held, viz. *Streptaxis*, *Magilus*, *Chilina*, *Papuina*, *Phasianella*, and São Thomé Shells. In addition there have been numerous smaller exhibits.

Since the Annual Meeting in October 1924, three numbers of the Journal have appeared : vol. 17, No. 6, Nov. 1924 ; No. 7, March 1925 ; No. 8, July 1925 ; comprising 96 pages of text, two plates, and nine text-figures. No. 9 is now in the press and will be published shortly : it will complete volume 17.

In order to add greater interest to published papers it was thought desirable that illustrations should be added wherever possible, and at the instigation of the President an Illustration Fund has been established. The Council hopes that this will meet with support from the members and all subscriptions to the Fund should be forwarded to the Hon. Treasurer.

During the year one of our members, Mr. B. R. Lucas, was appointed to represent the Society on the Manchester Museum Committee: the Hon. Secretary also attended as a delegate at the Conference of the Royal Microscopical Society at Sheffield in April, and Mr. B. Bryan (the Hon. Secretary of the North Staffs. Branch) attended as a delegate the Diamond Jubilee Celebrations of the North Staffordshire Field Club in June.

The Library has received numerous additions, the donors being Drs. W. H. Dall, P. Bartsch, J. Cosmo Melvill, L. Soos, Messrs. W. B. Marshall, H. Schlesch, A. S. Kennard, B. B. Woodward, T. S. Oldroyd, J. A. Grieg, H. Watson, W. J. Wintle, E. G. Alderson, J. R. le B. Tomlin, J. W. Jackson, G. C. Leman, Miss A. L. Massy, and Miss T. van Benthem Jutting. The Committee of the Manchester Museum, the Lancashire and Cheshire Fauna Committee, and the British Association have also presented their publications.

Donations to the Cabinet have been received from Messrs. A. K. Lawson, J. D. Dean, and A. E. Ellis.

Mr. H. Schlesch has also presented a number of portraits of conchologists.

The reports of the London, Yorkshire, and North Staffs. Branches, together with that of the Recorder for Non-Marine Mollusca, are appended. Owing to absence abroad the Recorder for Marine Mollusca has been unable to draw up a Report.

RECORDER'S REPORT (Non-Marine Mollusca).

SINCE the last report (vol. xvii. p. 222) the following new records, 36 in number, have been authenticated for the census:—

- Somerset S. (5):**—*Valvata cristata*, *Pisidium nitidum* (L. W. Grensted).
Dorset (9):—*Phytia myosotis*, *Ovatella bidentata* (J. E. Cooper).
Sussex W. (13):—*Hyalinia rogersi* (J. G. Dalgliesh).
Sussex E. (14):—*Zonitoides nitidus* (A. E. Ellis).
Surrey (17):—*Vallonia pulchella pulchella* (L. W. Grensted).
Oxford (23):—*Vallonia pulchella pulchella* (L. W. Grensted).
Bucks (24):—*Pseudanodonta rothomagensis*, *Cæcilioides acicula* (J. E. Cooper).
Cambridge (29):—*Pisidium obtusale* (C. Oldham).
Bedford (30):—*Vallonia excentrica* (A. E. Ellis).
Huntingdon (31):—*Zonitoides excavatus*, *Balea perversa*, *Planorbis nautilus*, *Segmentina nitida* (E. Peake).
Gloucester E. (33):—*Arion subfuscus*, *Vallonia pulchella pulchella*, *V. excentrica*, *V. costata* (A. E. Boycott).
Gloucester W. (34) and Hereford (36):—*Paludestrina jenkinsi*, *Pseudanodonta rothomagensis* (R. Wye: E. W. Bowell).
Pembroke (45):—*Agriolimax lævis*, *Pisidium hibernicum* (C. Oldham).
Anglesea (52):—*Planorbis vortex*, *Pl. glaber*, *Paludestrina jenkinsi*, *Pisidium henslowanum*, *P. personatum* (C. Oldham).
Lincoln S. (53):—*Valvata macrostoma* (New River, Cowbit, Spalding: J. F. Musham).
Lancashire S. (59):—*Cæcilioides acicula* (L. W. Grensted).
Durham (66):—*Limax cinereoniger*, *L. tenellus* (T. R. Goddard).

Northumberland S. (67):—*Zonitoides excavatus* (E. P. Blackburn).

Forfar (90):—*Hyalinia lucida* (garden), *Succinea elegans* (H. Coates).

Paludestrina jenkinsi which was first found in fresh water about 1893 (A. T. Daniel, vol. vii, p. 325) has now been authenticated for 55 of the 72 vice-comital areas of England and Wales: it is still missing for 9 of 27 inland, and for 8 of 45 maritime, areas.

REPORT OF THE LONDON BRANCH.

WITH an increased membership we have had a very successful year, and the attendance at the evening Meetings has been such as to test the capacity of my office (10, Bush Lane, E.C. 4), where the Meetings are held. Mr. A. S. Kennard, F.G.S., A.L.S., Mr. J. E. Cooper, and Lieut.-Col. A. J. Peile, R.A., were responsible for the year's Syllabus of Exhibits, and also for the notes on the species at each Meeting. Special mention must be made of the *Sphærium lacustre*, shown by Mr. Charles Oldham, F.L.S., in March, and of the very fine set of *Enneinæ*, exhibited by Lieut.-Col. Peile, in May. The thanks of the Branch are due to Major M. Connolly and to Mr. J. R. le B. Tomlin, M.A. for their frequent kind loans of specimens and of books descriptive of the species under discussion. Three Field Meetings were arranged, but the weather was not favourable for successful collecting.

J. C. DACIE, *Hon. Sec.*

ANNUAL REPORT (1925) OF THE YORKSHIRE BRANCH.

OF the eleven meetings arranged for the Session, two, including the Annual meeting, have not yet been held.

The opening meeting in January was devoted to a general display of *Helicella virgata*, which was preceded by a valuable paper on the species, by Mr. J. W. Taylor, M.Sc. The history of the species since its first description by Dr. Lister in the 17th century, its food, habits, fossil forms, distribution and variation, were ably dealt with at some length by the lecturer.

At the February Meeting, Mr. H. C. Versey, M.Sc., gave an interesting account of the "Geological Significance of Molluscan Remains," admirably illustrated by the lantern.

In March, Mr. E. E. Gregory gave as his Presidential address a lecture, entitled: "Palæo-Conchology," in which he sketched the history of the Mollusca from their first appearance in geological times. The lecture was admirably illustrated by specimens from the President's cabinets.

In October, Mr. Hy. Crowther, F.R.M.S., F.Z.S., President of the parent Society, gave a most interesting and inspiring address on "The Mouth of the Shell"; this was illustrated by a large number of specimens from Mrs. Crowther's cabinets, and also by South and Central American Land-Shells, from the Atkinson Memorial Collection.

Highly interesting general exhibits have been made and described at all indoor meetings.

The four Field Meetings held during the spring and summer months have been better attended than in the past few years, and good local work has been done.

Mr. E. E. Gregory has succeeded Mr. F. Rhodes, F.E.S., as President of the Branch.

Mr. J. F. Musham, F.E.S., who served the Branch so well in the capacity of Hon. Treasurer for over twelve years, has, owing to removal from the County, felt it necessary to relinquish office; he is succeeded by Mr. H. J. Armstrong.

In March, the Hon. Sec., Mr. H. L. Stephenson, resigned office and was succeeded by Mr. J. Digby Firth, F.L.S., who is now acting in that capacity.

During the last few years the membership roll has been gradually depleted by loss of members by death, and through removals from the County.

A determined effort is now being made to popularize Conchological pursuits, especially among the younger generation, and at the same time increase the membership of the Society.

The Branch has already met with some success in this direction, and it is hoped the efforts made will also ultimately serve the parent Society. Membership 34, including 2 Honorary and 2 Corresponding Members.

J. DIGBY FIRTH, *Acting Hon. Sec.*

REPORT OF THE NORTH STAFFORDSHIRE BRANCH.

MEMBERS of this Branch had the pleasure of listening to an interesting and instructive paper on "The Distribution of *Pisidia* in the Oakamoor District of the Churnet Valley (N. Staffs.)," by Mr. W. E. Alkins, read at an evening meeting of the N.S. Field Club. The paper will appear in the forthcoming number of the Club's transactions.

The following mollusca have been reported by members as having been found in our district during the past year, viz: *C. hortensis* var. *olivacea* and var. *incarnata roseozonata*; *C. nemoralis* var. *libellula* and *rubella*, with the banding 00300 in the form *hyalozonata-albolabiata* (W. E. Alkins); *C. hortensis* var. *albina* and one with the banding 103 (45); *S. edentulum*, not uncommon at Ilam Rock (W. Hill).

Milax gagates was found in numbers in an old garden near Longton, consisting of the var. *rava*. The previous record of this species in Staffs. is two specimens obtained at Stafford, by Mr. Lionel E. Adams, many years ago.

I had the honour of being elected delegate to represent this Society on the occasion of the Diamond Jubilee of the North Staffs. Field Club in June last, when most of the corresponding societies sent delegates. Owing to the dry weather prevailing during that week, no mollusca worthy of note were found.

B. BRYAN, *Hon. Sec.*

541st Meeting, held at the Manchester Museum, November 4th, 1925.

Mr. G. C. Spence in the chair.

Resignations.

T. O. Bartlett.

Dr. W. Horton-Smith.

Papers Read.

"*Clausilia bidentata* var. *albina* on the Firth of Clyde," by Fred Rhodes.

"Shell Pockets of Oxwich Dunes," by H. E. Quick.

"Oecological Notes on the Oxwich Sand Dune Area," by H. E. Quick.

"A Short Survey of the Mollusca and Brachiopoda of Japan, including Formosa and the Loochoo Islands" by J. G. Dalglish.

Exhibits.

By Mr. E. R. Brown: *Ancillaria elongata*, *cingulata*, *albicallosa*, and *montrouzieri*; also *Terebellum subulatum* and var. *punctatum*.

By Mr. J. W. Jackson: A selection of Australian Shells, donated to the Manchester Museum by Professor W. L. Bragg.

542nd Meeting, held at the Manchester Museum, December 2nd, 1925.

The President, Mr. J. W. Taylor, in the chair.

Additions to Library announced and thanks voted :—"The Lancashire and Cheshire Naturalist," vols. 12 to 17 (presented by J. W. Jackson).

"Études sur l'Anatomie et la Systématique des Maillots (Fam. *Pupillidae* s. lat.)," by C. M. Steenberg (from the author).

"Illustrations of Unfigured Types of Shells in the Collection of the United States National Museum," by W. H. Dall (from the author).

Also a batch of reprints of his own papers, presented by Dr. W. Polinski.

New Members Elected.

Dr. Francis E. Atkinson.

F. W. Fierke.

Candidates Proposed for Membership.

Mr. R. T. Millott, F.Z.S., F.E.S., Waverley Road, Mansfield (Headmaster, Newgate School, Mansfield) (introduced by J. W. Jackson and J. W. Taylor).

Mr. Sohtsu G. King, 11, Kaka Hutung, Tungsze Pailou, Peking, China (introduced by J. R. le B. Tomlin and J. W. Jackson).

Resignation.

J. N. Millott.

Member Deceased.

Bernard Arnold.

Papers Read.

"*Paludestrina jenkinsi* in Pembrokeshire."

"*Valvata macrostoma* in Cambridgeshire."

"*Pisidium lilljeborgii* in Anglesey," all by Chas. Oldham.

Exhibits.

By Mr. Charles Oldham : Specimens to illustrate the above three papers.

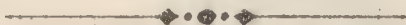
By Mrs. Gill : Growth stages of *Cypræa thesites*.

By Mr. A. K. Lawson : Original reversed specimens of *Limnæa pereger*, from Leeds and Durham.

By Mr. J. W. Taylor : *Helicella virgata* and sinistral example, collected by C. Ashford, in 1879, at Afton Downs, Freshwater, I.W. (now in the Society's Cabinet).

By Mr. J. W. Jackson : *Opeas beckianum* (Pfr.), from banana roots, Rowntree's Tropical House, York (coll. H. Britten, jr.); *Margaritana margaritifera* (L.) from Aughrim River, 2 miles above Woodbridge, Co. Wicklow (coll. A. W. Stelfox); *Paludestrina jenkinsi*, from Plas Llanfaglan, near Carnarvon (coll. Dr. C. L. Walton); *Planorbis albus*, from Llanerchymedd, Anglesey (coll. Dr. C. L. Walton).

The Special Exhibit was *Partula*, upon which Prof. S. J. Hickson gave an interesting talk, and also drew attention to Dr. H. E. Crampton's recent Memoirs on the genus.



Accounts for the Year ended December 31st, 1925.

Income and Expenditure Account.

RECEIPTS.			EXPENDITURE.		
	£	s. d.		£	s. d.
To Balance from last Account	21	6 3	By publishing and distributing		
„ Annual Subscriptions			<i>Journal of Conchology</i> :		
for 1925:			Vol. xvii. no. 7	32	2 8
148 at 10/-	74	0 0	„ no. 8	32	19 0
3 at 7/6	1	2 6	„ no. 9	38	17 1
38 at 5/-	9	10 0		103	18 9
	84	12 6	„ Authors' Reprints	19	10 6
Arrears	11	5 0	Less provision in		
	95	17 6	account for 1924	5	0 0—14
„ Donations towards cost of			Warehousing Stock	1	10 0
Illustrations	5	15 0	„ Printing and Stationery	3	15 9
„ Sale of Publications	31	14 8	„ Fire Insurance	0	10 0
„ Advertisements	2	15 9	„ Subscriptions:		
			Malacol. Society	1	1 0
			Zoological Rec.	2	12 2
			Lancs. & Chesh.		
			Fauna Com'tee	0	10 0
				4	3 2
			„ Officers' Expenses:		
			Secretary	4	15 10
			Treasurer	1	15 2
			Editor	0	13 6
			Recorder	0	1 7—7
			„ Balance, being excess of		
			Income over Expenditure	21	14 11
	£157	9 2		£157	9 2

Life Membership Fund.

	£	s. d.		£	s. d.
To amount of Fund, Jan. 1st,			By Commission on purchase		
1925	175	19 6	of Stock	0	2 6
„ Three Composition Fees at			„ Amount of Fund, Dec.		
£6/6/0	18	18 0	31st, 1925	212	2 11
„ Donations by Life Members	8	3 0			
„ Dividends and Interest	9	4 11			
	£212	5 5		£212	5 5

BALANCE SHEET.

Liabilities.	£	s. d.	Assets.	£	s. d.
Annual Subscriptions paid in			4% Funding Loan, £250	0	0
advance	5	0 0	cost	200	0 0
Life Membership Fund	212	2 11	Cash at Bankers	38	17 10
Balance of Income and Ex-					
penditure Account	21	14 11			
	£238	17 10		£238	17 10

NOTE.—Assets in addition to those set out in the Balance Sheet are (a) Library, (b) Cabinets and Collections; (c) Stock of unsold Publications; (d) Annual Subscriptions in arrear.

Audited and found correct, 28th December, 1925.

CHAS. OLDHAM,

Hon. Treasurer.

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GILES OWEN } Auditors.



J. D. Dean, del.

See pp. 21-24.

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It is believed that students of the Mollusca will find material of value to them in these volumes, whether they are interested in species of the world, or in those of a local fauna.

In the later volumes the fossil forms also, of the genera dealt with, are classified and listed.

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VOL. 18].

SEPTEMBER, 1926.

[No. 2.]

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THE
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OF
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T H E
JOURNAL OF CONCHOLOGY.

VOL. 18.

SEPTEMBER, 1926.

No. 2

OBITUARY NOTICE: WILLIAM EVANS HOYLE.

By J. WILFRID JACKSON.

DR. WILLIAM EVANS HOYLE died on February 7th last at Porthcawl. He was born at Manchester in 1855 and had a varied and interesting career, winning prizes in the engineering, chemical and biological departments of Owens College. He graduated in the Natural Science School at Oxford University in 1877, taking biology and chemistry as his subjects and obtaining first-class honours. He subsequently studied medicine at St. Bartholomew's Hospital, London, where he won several distinctions. His scientific and medical studies were continued in Vienna until he was appointed Demonstrator in Anatomy at Owens College. In 1882 he took up the post of naturalist on the editorial staff of the Challenger Reports at Edinburgh, retaining the position until his appointment, in 1889, as Keeper of the Manchester Museum (changed to Director in 1899). In 1909 he was appointed Director of the National Museum of Wales, and held that post until 1924.

During Dr. Hoyle's tenure at Edinburgh, the Cephalopoda collected by H.M.S. Challenger were placed in his hands for detailed examination and description. Preliminary diagnoses and reports on some of these animals were published by him in 1885 and the final report in 1886. During later years Hoyle carried on investigations into the anatomy, embryology and distribution of members of this group and published many papers relating thereto, including reports on specimens collected by Herdman at Ceylon (1924), by Stanley Gardiner at the Maldives and Laccadives (1905), by the National Antarctic Expedition (1907), and the Scottish National Antarctic Expedition (1912).

When Hoyle took up his position as Keeper at Manchester the new Museum Buildings had only just been opened, and he had the arduous task of arranging the accumulated collections in the various cases. The organisation of the different sections of the Museum occupied a great part of his time during the early years. The Museum Library was also placed by him on a satisfactory footing,

and the books were arranged in accordance with the Dewey decimal system, a system which, it is believed, he was the first in England to apply. A Catalogue of the books and pamphlets in the Library was published by him in 1895. The reorganisation on modern lines of the Library of the Manchester Literary and Philosophical Society was also superintended by him.

Early in 1896 Hoyle gave a series of Museum demonstrations specially designed for teachers, and throughout his career at Manchester he gave numerous lectures and demonstrations in the Museum on a variety of subjects, including Egyptology. In later years he visited numerous Museums in Europe and America and thus gained considerable experience in the planning, construction, and general principles of Museums.

Dr. Hoyle was an active member of the Museums Association from its commencement in 1890, and was elected President in 1906, taking as the subject of his Presidential Address, "The Education of a Curator." At the various meetings of that Association he was always welcome, and was ever ready to communicate to the members the results of his Museum experience. In 1907 he became the President of the Zoological Section of the British Association and gave an address at the Leicester meeting on Recent Cephalopoda. He became a member of the Conchological Society in 1886 and served on the Council and as Librarian, Secretary, and Editor of the *Journal of Conchology*, for many years. He occupied the Presidential chair in 1894, and addressed the Society on "The Classification of the Pelecypoda." In 1901 he collaborated with G. W. Chaster, J. Cosmo Melvill, and G. A. Frank Knight, in the preparation of a "List of British Marine Mollusca and Brachiopoda," and in 1907 he published a "Catalogue of the Library of the Conchological Society."

Hoyle's researches and writings were not confined to the Mollusca. He published papers on a variety of other subjects, especially during the early part of his career. The list is too long to give here and may be consulted in the Royal Society List of Scientific Papers.

Note on *Pyramidula*.—*P. rotundata*: I have found var. *rufula* in woods at Sibbertoft, Northants, April, 1923, and near Stow Wood, Oxford, May, 1922. I found a specimen of var. *alba* under an oak log amongst bracken in a dry place in Bagley Wood, Berks., May, 1923; I have received this variety from Mr. O. W. Richards, collected at Little Hampden, Bucks., July, 1921. *P. rupestris*: collected by Mr. O. W. Richards, Sept., 1921, in Savoie (Val d'Isère), France, with var. *conoidea*. *P. ruderata*, same locality (O. W. R.)—A. E. ELLIS.

OBITUARY NOTICE : ALEXANDER ABERCROMBIE.

By J. COSMO MELVILL M.A., D.Sc.

It is with deepest regret that I have heard of the passing of this old friend, on 12th May last, at Cheltenham.

About 1888 Mr. Abercrombie returned to England, after several years' absence in Bombay, he being one of the partners in the East Indian House of Wilson, Latham & Co. (formerly Gladstone, Latham and Co.) of Manchester and Liverpool, and Ewart, Latham & Co., Bombay. Thereupon, his and my friend, the late Mr. Arthur Latham, whom I have known many years (having been a contemporary of his at Harrow School, and likewise at Trinity College, Cambridge), gave me an introduction to Mr. Abercrombie, who had taken up the study of the Bombay mollusca most assiduously, and made considerable collections, which he had brought home with him. He at once invited me to aid him in their arrangement. He had already learnt much about the nomenclature, being associated with such known enthusiasts as Mr. E. H. Aitken, Mr. Comber, and other members of the Bombay Natural History Society, and when we had satisfactorily arranged the larger and more conspicuous Mollusca in the collection, I recommended him strongly to procure shell sand, which came to hand in due course, and was productive of many novelties of the minuter species, although a large proportion was beach-rolled and not in such good condition as if it had been dredged. A joint paper by us appeared in the "Memoirs of the Manchester Literary and Philosophical Society," 1893, which comprised between 300 and 400 species, and this total was subsequently augmented by others, mostly minute kinds also. Although Mr. F. Stoliczka, Rev. S. Fairbanks, Messrs. Geoffrey and Hugh Nevill, the Messrs. Blanford and others had prosecuted certain researches into this little known Fauna, it remained not very deeply known till Mr. Abercrombie's collections came to light. Subsequently, he generously bestowed them on the Manchester University Museum.

I am not aware whether he was a member of either our Malacological or Conchological Societies, but I think not. Still he accomplished so much in this little worked and very interesting portion of our Empire's possessions, and, besides, was the means of introducing Commander E. R. Shoplund, and especially Mr. Frederick W. Townsend, to British malacologists, that he richly deserves to have his great services to science duly acknowledged.

Till Mr. Townsend's famous dredgings in the Persian Gulf were subsequently examined and reported on, with, in all, about 2,000 species enumerated, about a third of which were new to science, hardly anything had been recorded for that region.

It was found that a large proportion of Mr. Abercrombie's discoveries at Bombay were in the Townsend collections, made further north, thus confirming them, and increasing their known area of distribution. He, therefore, will always be remembered as a very successful pioneer of the science as regards that most important seaport, Bombay, and its surroundings, for all time.

NOTE.—Since writing the above I have ascertained that he was for a few years a member of the Malacological Society of London.



Pisidium lilljeborgii in Anglesey.—Most of the known Welsh stations for *P. lilljeborgii* are mountain tarns, but some time ago Mr. A. W. Stelfox detected a specimen in a gathering made by Mr. J. G. Milne in 1886, in Llyn Maelog, a shallow lake at sea-level. When in Anglesey in July, 1925, I confirmed Mr. Milne's find of nearly forty years ago, and also took *lilljeborgii* in Llyn Coron, a lake about four miles from Llyn Maelog, and like it, shallow, with a stony bed, clear water, a sparse vegetation which includes such montane plants as *Lobelia dortmanna* and *Subularia aquatica*, and bounded by blown sand on the side nearest the sea. *Anodonta cygnea*, *Sphaerium corneum*, *Valvata piscinalis* and *Planorbis glaber* are common to both lakes, and both have been colonized in recent years by *Paludestrina jenkinsi*. The *Pisidia* were taken in pure sand along the seaward edge of the lakes. The associated species in Llyn Maelog were *lilljeborgii*, *casertanum*, *subtruncatum*, *pulchellum*, *nitidum*, *miliun* and *hibernicum*. In Llyn Coron the same species were found, except *hibernicum*, but with *henslowianum* in addition. Mr. Stelfox tells me that *P. lilljeborgii* occurs at sea level in shallow lakes on Achill Island and in West Donegal, where it is always associated with *Planorbis glaber*.—CHAS. OLDHAM. (Read before the Society, Dec. 2nd, 1925).

Valvata macrostoma in Cambridgeshire.—So little is known of the distribution of this species that it may be well to record its occurrence at a place some six miles higher up the river than the station at Ely, where it was found in 1921 (*J. of C.* xvi. p. 251). In May, 1925, I took it in plenty in a shallow drain communicating with the Cam, in a field at the foot of the inn garden at Upware. Its associates were *Limnaea pereger*, *Planorbis vortex*, *P. carinatus*, *P. corneus* and var. *albinos*, *Valvata cristata*, *Bithynia tentaculata*, *B. leachii* and *Sphaerium lacustre*.—CHAS. OLDHAM. (Read before the Society, Dec. 2nd, 1925).

OBITUARY NOTICE: C. E. WRIGHT.

By THE EDITOR.

WE regret to have to record the death of one who was an old-standing member of our Society, though he ceased to belong to it several years ago. Most of the following details are taken from a notice which appeared in a Kettering newspaper.

Charles East Wright was the son of William Wright, a builder, of Rothwell, who died at a comparatively early age, leaving behind him a young family of two sons and four daughters. The Wrights then moved to Kettering, C. E. Wright being nine years old at the time, and subsequently he entered the shoe factory of his relative, Mr. Chas. East.

Eventually he and his brother William started in partnership as boot manufacturers at Kettering, and carried on this business for nearly 40 years.

He was the first Kettering recruit when the Volunteer movement began in 1867, and continued his active association with it until he reached the age limit and had to retire. At one time he held the rank of Colour-Sergeant, and was the senior Non-commissioned Officer in the Battalion.

During the war he held the position of Transport Officer for his district. He died on May 6th last at the age of 76, and was buried at Kettering.

He leaves a widow, two sons, and three daughters.

It is interesting to note that he was a cousin of the late Sir Alfred East, R.A.

Wright was an extremely keen naturalist, and had been President of the Northants History Society, and Vice-President of the Kettering and District Natural History Society.

His chief bent always lay in the domain of conchology; he was elected a member of our Society on February 6th, 1895, and was at one time a Vice-President. He appears in the photographic group which is to be found as frontispiece to vol. xi. of the *Journal of Conchology*, and it is much to be regretted that such a group has not become an annual event.

As far as I know, the experiment has never been repeated since this most successful picture was taken in 1904.

Wright was essentially a field naturalist, and unfortunately wrote very little. I believe that the following is a complete list of his contributions to our Journal :—

Vol. viii, p. 151. *H. hortensis* m. *sinistrorsum* in Northants.

„ „ p. 395. Colony of *C. acicula* in Northants.

„ ix, p. 58. New Forms of *H. terrestris*.

„ xi, p. 96. *Succinea oblonga* var. *alba* nov.

„ xii, p. 268. *H. nemoralis* eaten by rabbits.

„ xii, p. 282. *V. antivertigo* in Northants.

In Collaboration with H. Beeston.

„ xi, p. 72. L. and F. W. Mollusca of Ilfracombe and District (supplementary list).

In Collaboration with L. E. Adams.

„ xi, p. 223. Notes on the W. Cornwall District.

Wright described three new varieties, viz. :—

H. terrestris var. *maculata*.

„ „ var. *fulva*.

Succinea oblonga var. *alba*.

Of these the var. *maculata* is evidently a synonym of var. *maculosa* Moquin-Tandon, while the var. *fulva* seems equivalent to the var. *hypochroma* of the same author.

Sphaerium pallidum (Gray) in **Oxfordshire**.—The occurrence of *S. pallidum* in the canal at Banbury is perhaps worth more than a mere notice in the Recorder's list. I took four specimens, two living, during a casual walk by the canal on Jan. 10th. Doubtless a systematic search would reveal it in numbers. There is no sign of the species further South, at Oxford, and it is perhaps worth noting that *P. jenkinsi*, which is abundant at Banbury, is very rare at Oxford. The other species taken were the same in the two places. *S. pallidum* was originally found in French localities, in which it has apparently long been extinct. In this country it began its career in the Paddington canal, but has now vanished from the London area and become almost entirely a Northern species. It used to be abundant round Manchester, though there too it seems now to be much less common. The Banbury locality perhaps marks its present Southern limit, though there seems no reason at all why it should not spread southwards, as, apparently, it originally went northwards, by the canal system.—L. W. GRENSTED. (*Read before the Society*, 3rd February, 1926).

Distorted *H. itala* at Folkestone.—Whilst at Folkestone recently I spent about half an hour on the slopes above the Lower Sandgate Road selecting a short series of *H. itala* from the hundreds which may be seen there. During this short time I found two specimens in which the second year's growth had taken an irregular course, elevating the centre whorls on one side and depressing them on the other, giving them a tilted appearance. If two such specimens can be picked up in so short a time, it seems to suggest that careful search by someone with more time at their disposal would be well repaid.—A. K. LAWSON (*Read before the Society*, Nov. 5th, 1924).

SOME CONCHOLOGICAL BYWAYS.

By HENRY CROWTHER, F.Z.S., F.R.M.S.

Curator of the City Museum, Leeds.

(Presidential Address delivered at the Annual Meeting, October 24th, 1925).

CONCHOLOGY, which was so popular among the middle class a century ago, somehow, some fifty years later lost its vogue. Among the "Friends" especially, the possession of a collection of shells and a fair knowledge of them were part of their education. Later days, later habits, and conchology ceased to be a fashion. There are still followers of the study outside the trend of museums and societies. Other sciences are being keenly followed, and nature study, as taught, recognises botany perhaps as the most attractive. Of the new studies the Dipterist, in spite of his lack of literature, and the frailness of his material, is forging ahead into public recognition, and rightly so, as the insect is often the connecting link between health and disease.

The making of collections, judging by the offers of them as gifts to museums, is passing away. And yet how charmingly interesting were the dissertations on their collections by the former owners. To them, every object had a personal history, a joy, a remembrance, a pleasure. Buffon, a writer of their day, tells us that "to understand Testaceous Fishes we must have recourse to the garden snail which carries its box on its back. The part where the animal enlarges is at the mouth. Being about to enlarge its shell it is seen with its little teeth biting and clearing away the scaly skin which grows at the edges. It is sometimes seen to eat the bits it thus takes off, and at other times it only clears away the margin when covered with films, and then adds another rim to its shell. Though the animal's mouth may appear too soft a substance to be furnished with teeth, yet it has no less than eight of them, with which it bites off pieces of its own shell. Of sea shells there are fifteen kinds, freshwater snails eight kinds, land snails five kinds." What a contrast to conchological knowledge of to-day!

Perhaps the falling away of the habit of making British collections was due to lack of colour in our land, freshwater and marine shells, for except some helices and scallops they are practically monochromatic.

Since those days the conchologists have varied their methods of dealing with the mollusca. To them the shell is not a shell and nothing more, not merely a protection for a soft body but a record of its life. To our way of thinking it is along this line of thought that the conchologist may revivify and popularise his science. It is so much easier to make a collection of shells alone than of shells with their animals, bearing in mind that there is no chance design in the

building of the shell, that every spine and flexure has some meaning, and though whether a snail can think, or is actuated by blind inheritance, may concern us not, this blending of form, colour, beauty in solid carbonate of lime and aragonite is a reflex of its designer and a measure of its suitability to its environment.

The student may be a malacologist and a conchologist, rarely the latter only, for around the mollusca has grown, or has been built up a series of collateral studies, for the biologist has added the snail and the mussel to his studies of types of animal life. Is there a danger of the zoologist preventing the study of molluscan shells purely and simply? Is the collecting, or making a collection of shells, apart from their beauty, a thing of the past? As a Society can we not devise some means by which the collector may retain an intelligent interest in his specimens? Are there any byways along which he may travel with a promise of unexpected usefulness to science?

To-day a greater interest is being taken in the study of the snail than of its shell. Early classifications of the mollusca by shell form have been modified; the microscope has revealed affinities in the radulæ, and other organs, which have led to the placing of forms of mollusca in classes once thought unnatural to them.

As a Conchological Society we lean to the differentiations of the shell but happily for us we recognise, too, the modifications of the animal. The older conchologists were alive to much of this influence between animal and shell; distribution they charmingly set out in their books, but they were not in touch with the minutiae of food, temperature, humidity, dampness, soil, the hydrogenation or the composition of water in the shaping of the shell. With these they were familiar in the abstract but not in the concrete. We must remember that microscopy was in its infancy, books few and expensive.

It will be clear to all that it is through the shell that we may best gain converts to the study of conchology. Through shell displays in museums we attract public notice, and it is equally certain that, given space, no class of objects could so simply convey to the lay mind the influence of varying conditions on animal life. We recognise that form and habits are allied,—the wide-mouthed shell, and its operculum; the indrawing of the shell aperture, and barricade of teeth as in the Cowries, *Pythia* and others; the siphonal notch of the Whelk, and *Strombus*; the equal multitoothed hinge in *Arca*; the locking tooth of *Spondylus*; the burrowing habits of *Solen*, *Pholas*, *Magilus*; the spiny growths of *Murex*; the ponderous defence of *Chama*; the trick of *Phorus* in artificially burdening itself with stones and shells; the glassy smoothness of the Cowries, and the lavish splashes of colour in the Olive and the Cone. It is perhaps this

modern reading of the shell that makes conchology so interesting. This leads the conchologist along unsuspected byways so that even the simple study of the shell and its maker may be a means whereby the past and the future life of the mollusc may be better understood and predicted.

The palæontologist recognises the value of the shells of the mollusca as indicators of strata and zones. By a fossil mussel, be it *Carbonicola* or *Anthracosia*, we may trace coal seams disturbed by tremendous uplifts, or downthrows. By mutual alliance of geologists and conchologist the variations of many forms of molluscan life may be verified. In the rocks, the shell, not the animal counts as evidence, as the mollusc has usually perished without leaving a sign of its structure.

It is to Edward Forbes that we owe a byway of conchology, for it will be conceded that his memoir in 1846 on the connexion between the distribution of the existing Fauna and Flora of the British Isles, and the geological changes which have affected their area, was the start of what many students think is the most interesting phase of recent conchological research.

Prof. Osborn says:—“When Darwin published his “Origin of Species” no one had actually observed how one form of animal or plant actually passes into another.” It was among the mollusca that the transformation was noted. Wilhelm Heinrich Waagen, an Austrian palæontologist, set forth his observations on *Ammonites subradiatus*, as mutations. It is now recognised that they represent a true evolution of the heredity-chromatin, a fundamental law of the evolution of form. Twenty years later Neumayr defined mutation “as the tendency of form to evolve in certain definite directions.” We speak of these great factors of science with ready acquaintance to-day. A brachiopod *Spirifer mucronatus* of the Mid-Devonian shows, too, these continuous character changes, one of the most important of biological laws; certain new characters arising definitely; continuous adaptivity.

How frequently have we found the sculpture of a shell an aid in its specific classification, counting *Cardium lyratum* a treasure, because of the dissimilarity of its markings on one valve. Mr. W. B. Marshall, of the U.S. National Museum has found, by means of the microscope, a ready means of classifying certain fresh-water mussels. *Mutelidæ* are striated, not *Diplodon*, and other genera of *Unionidæ*. In *Spatha*, an African genus of the *Mutelidæ*, there are as many as 300 radiating threads per millimeter. Here is a byway for the use of the microscope in the classification of the *Naiads*. Except in the *Mycetopoda* from South America, radiating lines are a characteristic feature of the *Mutelidæ*.

L. Boutan has shown that nacre consists of 75 to 90% of CaCO_3 , the organic material chiefly conchyolin and water, and Harley gives the composition of pearl as 92% of carbonate of lime, the rest conchyolin and water. R. Dubois says that the organic matter appears to form a meshed or honeycomb structure, in the cells of which the mineral matter is deposited as minute crystals by migratory calciferous cells. In the pearl the conchyolin alveoli form a radiating frame work, as a pearl is built up of concentric cells.

The lustre of the pearl and the nacre are, it is suggested, due to the minuteness of the crystals. The lime is in the form of ortho-rhombic aragonite, its molecular structure 2 CaCO_3 Huggins, 4 CaCO_3 Bragg. Here the conchologist and the physicist unite in the study of the shell, and X-rays reveal the arrangement of crystals perpendicular to the plane of lamination and twinning of the crystals. The photographing of shells by means of X-rays has added another interest to the study of conchology. A feature of our science is its economic side, but of the cultivation of oysters, mussels, clams, and of the pearl-fisheries of the East, one need not labour, although the mussel-beds of Lancashire yield £40,000 a year to the cultivators.

In my hands is a sheaf of fascinating matter on the evolution and adaptation to environment of the mollusca, a wealth of suggestiveness which any conchologist may pursue by selection of fossil forms.

The new readings which geologists are giving us of the world's past history offer byways of study, especially in conchology, as the shells of the mollusca form the major part of the animal structures they handle. As Carl Dunbar expresses it:—"Inductive, evident relationship of living forms to definite and obvious environment. Deductive, as does the Palæobiologist in recovering glimpses of former habits of organisms long since existent; the latter indirect but ever seeking to fit hypothetic interpretation into unrelated facts: the path of hypothesis to theory, to fact."

One has no need to labour on the claims of the mollusca to the palæontologist, but one would love to linger here, to tell how the little *Ancylus* has a geological time named after it because it tells of a land oscillation in the Post-glacial Epoch of the Baltic Sea; or to recount the shell foods of prehistoric man in Zealand.

Yet another byway; it helps in the study of primitive man, and palæo-conchology links our science with Ethnology, for these ancients had a love of ornament, and as many as one thousand perforated shells of *Nassa neritea* were found as a belt on two skeletons of children from the Grimaldi caves. I have made a selection of those shells which attracted prehistoric man as food, barter or ornament.

In 1901 I lectured on "Some uses of Shells by Savage Tribes," with lantern illustrations of objects in the Leeds Museum; a subject

Mr. J. Wilfrid Jackson has embodied in published book form from material in the Manchester Museum.

Two interesting collections one wishes to place before the members, because the making of such is within the reach of every conchologist, and these lead along a line of study and research.

Certain worms cause diseases, some in man, others in vertebrate and invertebrate animals ; amongst mollusca they find an alternate stage in their development. *Isidora contorta*, Algiers, harbours *Schistosoma hæmatobium* ; *Limnæa catascopium*, Indiana, *Tetracotyle typica* ; *Limnæa truncatula* and probably *L. peregra*, the liver fluke ; *L. proxima*, California, *Cercaria kowadensis* ; *L. reflexa*, Lake Erie, *Cercaria reflexa* ; *L. humilis*, Hartland, *Fasciola hepatica*, our liver fluke ; *Physa heterostrophæ* Ohio, *Cercaria hyalocauda* ; *Succinea ovalis*, Ohio, *Leucochloridium* ; *Planorbis trivolvis*, Cincinnati, *Cercaria inhabilis* ; of land shells *Patula alternata*, U.S., *Ascaris cylindrica* ; *Polygra albolabris*, Michigan, *Cercariæum helici* are examples.

The second collection is unique, and its acquirement merely the result of patience. It deals with the killing of molluscs by Whelks and Murices, the drilling of holes through the shells, and the injection of poison through the hole. It is not a new invention on the part of the mollusc but there are mistakes made by drilling into empty whorls, and the retrials until the living animal is reached. These holes are in *Pectunculus*, from Calcaire Grossier, Paris, *Conus* from the Eocene of Barton, *Cytherea* from Mid-Miocene of Merignac, *Pectunculus* from the Red Crag, and other fossil forms.

The following living genera, so drilled, are in my collection : Bivalves :—*Cardita*, *Arca*, *Thracia*, *Spondylus*, *Chama*, *Tellina*, *Cytherea*, *Donax*, *Ostrea*, *Lucina*, *Dosinia*, *Meretrix*. Univalves :—*Cassis*, *Triton*, *Solarium*, *Fusus*, *Scalaria*, *Terebra*, *Cerithium*.

In a paper read before the Leeds Conchological Club one ventured to take up the so-called teeth of shells, which protect the animal in its shell, and amaze and perplex the conchologist by their variations. They suggest another byway for thought ; unfortunately one cannot always discover the enemy, for the best examples are exotic, as are the beetles and other enemies that prey on them.

May these few remarks on "Some Conchological Byways" suggest to some worker that we need not seek to possess that which only museums can afford, but by collecting or acquiring a series of some family or genus of shells which obtain only on an island, a lake, a canal, a pond, or a local sea he may have that happy experience of being amongst the earliest to record some new thing in Conchological Science.

SOME RARE MOLLUSCA FROM THE NEIGHBOURHOOD OF BORÅS, SWEDEN.

By B. SUNDLER.

(Read before the Society, March 3rd, 1926).

DURING the latter part of the summer of 1925, I had a few weeks' holiday, which I spent in visiting several regions, rich in molluscs, in the environs of Borås, partly in order to make collections for barter and partly in the hope of finding some species or varieties which might perchance hitherto have escaped my attention.

I made one excursion to a place, Risbro by name, situated on the Viskan, 12 km. north of Borås. The stream here forms a rather deep pond, very muddy in its lower part, and with a rich vegetation of *Potamogeton*, *Alisma*, *Nuphar*, *Batrachium* and others.

The Mollusc fauna is rich in representatives of many different genera. There are especially *Bithynia tentaculata* and *Sphærium corneum* in large quantities. There are also to be found *Amphipeplea glutinosa*, *Gyrorbis cristata* and *Cincinna piscinalis*.

This time no boat was to be had, and I had to content myself with using the scoop. I got lots of molluscs. In a tuft of *Potamogeton alpinus* I found some small *Planorbis*, which proved to be immature specimens of the rare *Gyraulus socius* West. I then scooped for them a long time, and also visited the place a month later without finding any. *Gyraulus socius* is nearly related to *G. albus*, but has the outer volution much more dilated towards the aperture than the latter. This is its most striking characteristic. Westerlund reports it from the provinces of Scania, Blekinge, Södermanland and Helsingland. I have it from Småland and now also from Västergötland, so that its range is rather large, but nevertheless, it must be counted one of our rarest kinds of *Planorbis*.

In connection with this find I may mention another which I made in the Viskan in 1922, a few hundred metres further down stream. The river here makes a little bend, which is very muddy, and where the current is feeble. In the deep mud at that place is to be found among others *Pisidium amnicum*. I was once scooping for this and unexpectedly found two specimens of *Amphipeplea glutinosa*. On closer inspection, I found that the margin of one of them was bent outwards at almost right angles to the shell, and even bent upwards, exactly as with certain specimens of *Limnæa stagnalis*, which live on muddy ground. The upwardbent margin is about 2 mm. broad at the broadest. On the other specimen also there is a tendency to dilation.

To come back to my excursion, I continued my way down to a place covered with mighty thickets of *Filipendula ulmaria*, in order to seek for *Eulota fruticum*, which is rare in this neighbourhood. I did not find it, but something better still, i.e., *Zonitoides nitidus* Müll. m. *sinistrorsum*. This is the first sinistral variety I have ever found, and I am not aware of any such being ever found in Sweden.

Not far from there is a place called Krökling hage, remarkable for a vegetation very luxuriant for our circumstances and accordingly with a very rich Mollusc fauna. From a botanical point of view the Borås region may, in some degree, be regarded as a place of meeting for northern and southern species, and this is still more the case with Molluscs. As an instance of this I may mention that in this pasture-ground two such decidedly northern species as *Vertigo arctica* Wallenberg and *Sphyradium columella* Benz meet with the southern and western *Acanthinula lamellata* Jeffr. I there succeeded in making two other finds, although I visit the place several times every summer in order to collect. I found a form of *Vitrea crystallina* which, as it seems to me, differed rather much from the typical form. Its shell is not crystalline, but of a light yellow or opaque tinge, and the margin is more or less red. I found it a couple of years ago, but I have not had time to occupy myself with it until now. It was to be found only in a very small space of a few square metres, where there is a little colony of *Acanthinula lamellata*. Observing this, I resolved to seek it at the other place where I had found *Acanthinula lamellata*, 10 km. farther to the south in the hills of Rya Åsar, and curiously enough I also found it there. This is probably only a coincidence, but still worth mentioning. Both habitats do not differ in any way from their immediate surroundings. In his diagnosis of *Vitrea crystallina*, Westerlund states that the margin is frequently red, but does not mention the other colour. As transitions between this and the typical form are not unfrequent, it probably cannot be characterized as a special form.

The other find in Kröklings hage was a specimen of *Cochlicopa lubrica* Müller, crystalline with a brown tinge and a white lip. The length is $6\frac{1}{2}$ mm. and the breadth $2\frac{1}{2}$ mm. The form is evidently identical with var. *hyalina* Jeffr. and not found in Sweden before.

Lastly, I made an unexpected find in the Lakhalls Hills, on Lake Öresjö, 5 km. north of Borås. I found two specimens of *Patula ruderata* Stud. var. *albida* Westerlund. Both specimens were found on the slope towards the lake and sitting under the bark of the mouldering stub of a spruce. They are slightly green in colour. Neither has this form been hitherto reported as found in Sweden.

MOLLUSCA FROM THE BELGIAN CONGO (iv).

BY GEO. C. SPENCE.

(Read before the Society, May 2nd, 1925).

YET another valuable collection of mollusca was made in 1923-4 in the Belgian Congo by Mr. F. M. Dyke, and through his generosity is now in my hands for investigation. The number of recognisable species is 42, in addition to a few which on account of condition or extreme youth are unidentifiable. As usual, Mr. Dyke has made most careful notes as to habitat and locality, thus providing valuable data with regard to distribution. The following records show considerable extensions of the previously known range of certain species.

The shells from the neighbourhood of Zambi were kindly obtained for Mr. Dyke by Mr. G. Lafarge.

Collections were again made at Boteke and Elizabetha. New localities are Zambi, Mateba Island, Kinshasa and Coquilhatville—all well-known places which can be found on any good map—and also at:

Yucataraca—an island in the R. Congo, separated from the mainland by a marsh and creek. Position $1^{\circ}30'N$; $20^{\circ}E$.

Basongo.—The following are near Basongo, Dt. du Kasai, which is situate at the confluence of the Rivers Kasai and Sankuru:

MAPANGU—12 km. S.W. from Basongo.

MOBENDI—18 km. W. from Basongo.

KAYAYA—18 km. W. from Mapangu.

MALINGA—35 km. W. from Basongo.

Ikenge— $0^{\circ}10'S$; $18^{\circ}50'W$.

Ingende— $0^{\circ}15'S$; $18^{\circ}55'W$.

Ifoma— $0^{\circ}12'S$; $18^{\circ}52'W$.

Bokala— $3^{\circ}15'S$; $17^{\circ}10'W$.

Kwenge— $5^{\circ}20'S$; $18^{\circ}40'W$.

Bofela— $1^{\circ}50'N$; $21^{\circ}0'E$.

My thanks are due, particularly to Messrs. Connolly, Dupuis and Watson, for much kind help.

Boteke.

Subulina pengensis Pils.

Pseudoglessula (*Ischnoglessula*) *cruda* Pils.

„ „ *depauwi* Dup. and Ptz.

Pseudopeas pulchellum Ptz.

Gymnarion sowerbyanus (Pfr.)

Prositala fernandopoënsis Germ.

Kaliella barrakporensis (Pfr.)

All under dead leaves in forest.

Mobendi.

Achatina bandeirana Mor. A magnificent specimen in which the flame markings persist on the last whorl instead of its being practically unicolorous as usual.

Achatina schweinfurthi Mts., var. *semifusca* Spence.

Ceras sp. One juvenile (12 mm. long) found amongst dead leaves at roots of forest trees. The early whorls in all the examples of *Ceras* which I have seen have short folds below the suture as in *Homorus*. This feature, which is very distinct, does not appear to have been noticed previously and tends, on conchological grounds, to confirm the position, next to *Homorus*, to which the genus has been assigned.

Subulina subangulata Dup. and Ptz. Under damp leaves in abundance. Many of them containing eggs of the usual *Subulina* type.

Pseudoglessula (*Ischnoglessula*) *cruda* Pils.

Pseudopeas plebium (Mor.)

Curvella campyla Conn. One rather immature example which I should not care to separate from *campyla* with the curious incised sculpture of which it agrees. The type of *campyla*, however, is covered with very fine spiral striæ, whilst the shell under notice shows faint traces of striæ on the protoconch only.

Gulella (*Paucidentina*) *monodon* (Mor.) A form in which the riblets are more pronounced than usual.

Gudeëlla mixta (Sm.)

The last five spp. all under dead leaves in forest.

Ledoulxia mesogæa (Mts.) In grass.

Gymnarion sowerbyanus (Pfr.)

Pleuroprocta silvatica Pils. (juv.),
Maizania intermedius Mts. } Under dead leaves in forest.

Elizabetha.

Helix pomatia L. This unexpected find (dead) must be an introduction. Tinned *aspersa* is eaten in the Congo so evidently someone has been indulging in tinned "escargots."

Perideriopsis fallsensis Dup. and Ptz. Amongst grass under forest trees. One of these is of the unusual type figured by Pilsbry in his "Review of the L.M. of the Belgian Congo," 1919 Pl. vi, Fig. 5.

Maizania intermedius Mts.

Ifoma.

Limicolaria lucalana Pils. (*jaspidea* Mor.). On forest path.

„ *martensiana* (Smith). Under dead leaves.

Perideriopsis umbilicata Putz. On forest path.

Pseudoglessula (*Ischnoglessula*) *depauwi*, Dup. and Ptz. Under dead leaves.

Ingende.

<i>Nothapalus pancispira</i> (Mts.)	} On path in recently felled forest.
<i>Pseudoglessula</i> (<i>Ischnoglessula</i>) <i>depauwi</i> D. and P.	
<i>Gulella laevigata</i> (Dhn.)	

Bofela.

Perideriopsis fallsensis Dup. and Ptz. and mut. *pronuba* Pils. On path in wood. A series showing great variability of pattern.

Ledoulxia mesogæa (Mts.). On path in wood.

Bokala.

Limicolaria lucalana Pils. (*jaspidea* Mor.). On path in plantation of rubber trees and climbing on palms (*Elaeis guinensis*).

Sanga Sanga Beach (35 km. West of Basongo).

Aetheria elliptica Lam. Examples of both the smooth typical form and the spiny *tubifera* Sow. from the R. Kasai where they are found in great masses on the mica-schist rocks in the river bed. Sowerby's *tubifera* has been merged in synonymy by some authors and maintained as a variety by others. This latter course seems the more desirable for this very distinctive form. The smooth and spiny are fused together in masses and absolutely refute the theory that one form is found in calm and the other in troubled areas of water.

Coquilhatville.

Achatina schweinfurthi Mts. On path near marsh.

Kinshasa.

Achatina sylvatica Ptz. and var. *unicolor* Pils. On sandy paths.

Kayaya.

Limicolaria lucalana Pils. (*jaspidea* Mor.). On grass plain.

Ikenge.

Pseudoglessula (*Ischnoglessula*) *depauwi* Dup. and Ptz.

Ptychotrema (*Ennea*) *bequaerti* (Dtz. and Germ.).

„ „ *silvaticum* Pils. One example of this minute but beautiful species.

Gulella laevigata (Dhn.).

Ledoulxia mesogæa (Mts.). All on forest paths.

Kwenge.

Achatina schweinfurthi Mts. A yellow unicolorous form.

Ptychotrema (Parennea) connollyi Dup. and Ptz.

Gymnarion sp. One spirit specimen. The protoconch of the shell has very clear apparently continuous spiral microscopic grooves, whilst the last whorl is minutely granulate, colour brown. The shell is completely membranous but does not appear to be degenerate in other respects, being comparatively large and having very little of its outer surface covered by the shell lobes of the animal, which are quite small. As far as can be judged from Thiele's description it is probably nearly related to his *Helicarion membranaceus*. This slug laid 6 soft light reddish brown eggs after capture.

Mapangu.

Achatina bandeirana Mor. Large typical example in forest.

„ *schweinfurthi* Mts. var. *semifusca* Spence.

Ampullaria wernei Phil.

Mateba Id.

Mutelina carrei Ptz.

Malinga.

Maizania intermedius Mts. In forest.

Maluku (on Stanley Pool).

Achatina zebriolata Mor. In bush near river.

Yucataraca.

Achatina tinctoria Rve. and var. *obliterata* Dtz. A series of 26 in various stages of growth from a "kitchen midden" outside a native village. These snails are used as food and collected by the natives in baskets or strung on a cord through a hole broken through the outer lip. Twenty are typical and the remainder the varietal form. Largest example 120 mm. in length.

Zambi.

Achatina tinctoria Rve.

Lanistes ovum Peters.

„ *libycus* Mor.

Yambila nr. Baroko, Dt. de l'Aruwimi (at confluence of Congo and Aruwimi).

Achatina weynsi Dtz.

NOTES ON THE MOLLUSCA OF STALYBRIDGE.

BY C. H. MOORE.

(Read before the Society, December 3rd, 1924).

It has long been a matter of interest to the writer that watercourses and their causes are such a determining factor in the distribution of species and varieties.

In the neighbourhood of Stalybridge, a town on the border line of Lancashire and Cheshire, and also not far from Yorkshire and Derbyshire, this illustration of cause and effect is very noticeable, and the species collected at various periods show that there is quite a marked difference between the fauna of the right bank of the stream and that of the left.

In the first place the geological strata consist on one bank of millstone grit, and on the other of an outcrop of the coal measures.

The stream meanders between the two sets of rocks, and it is interesting to note that though on the one side only a few Zonitidæ are to be found, on the other side there are to be collected *Gonyodiscus rotundata* and even at times *Hygromia hispida*. To my mind this illustrates the great part played by the outcrops and their resultant food plants in the distribution of species.

When the food plants contain a good proportion of lime, we find molluscs with hard and in many cases thick shells, but when the opposite obtains, the shells are mostly thin.

Again the progress of civilisation and modern alterations to the face of the landscape affect to a considerable degree the distribution of shells.

It will be noticed that the species from the one side of the stream were nearly all collected prior to the year 1902, when a local tramway was laid along the road, by the side of which they were found, and the excavated earth was thrown on to the hedge sides and absolutely exterminated several of the species which were to be found there before that period.

In the winter of 1901/2, the following species were found in the hedge bank of Mottram Road:—

Vitrea crystallina (7), *Polita alliaria* (40), *Polita nitidula* (7); but after that date many searches for them have been in vain.

V. crystallina has been found in Bury-Mi-Wick as late as 1910 (15), *Polita cellaria* sparingly 1901/2 (2), *Polita alliaria* 1910 (11), *Polita nitidula* 1907 (2), *Polita radiatula* 1910 (4), with variety, *Euconulus fulvus* to 1916 (1), *Gonyodiscus rotundata* 1916 (2), *Hygromia hispida* 1910 (3), *Hy. concinna* 1902 (1), *Cochlicopa lubrica* 1909 (1).

These observations all tend to show that the land shells on the sandstone side of the stream were very few in number, and that the road alterations very quickly exterminated them. On the other side of the stream the coal measures contributed to an increased number of species, and as they have not yet been subject to the detrimental conditions which prevailed on the other side of the stream, *they* still continue.

Again attention has been drawn to the very divergent conditions in which various water shells are found. *Ancylus fluviatilis* was found in a roadside well at Millbrook, Stalybridge, of large size but with very thin shells, in 1905-8-9. In a brook at Matley, Stalybridge, under the influence of running water, the shells were small but very sturdy in 1902-3-4.

Limnæa truncatula was found in a small roadside horse trough very small in size in 1909, and from a pond at Millbrook in 1903. The variation in size is remarkable.

Physa heterostropha has worked its way up the Huddersfield canal a matter of one mile from Stalybridge, and in 1907 *Valvata piscinalis* was found in great quantities in the said canal, but the next year very few were to be seen.

There is only one known Stalybridge locality for *Anodonta cygnea*. This is the reservoir belonging to a Millbrook mill. How it was introduced is an unsolved problem, but in January, 1917, the species was to be seen in quantity.

These few observations all seem to point out the great effect which soil and civilization have upon our Mollusca fauna, and probably many interesting problems respecting distribution of species would be solved if we could tabulate the events which are constantly taking place, as it were, under our eyes.



Arion subfuscus var. **succinea** Bouillet.—On April 20th I found a specimen of this variety at Moortown, near Leeds, and in looking through Mr. Taylor's Monograph I find that it has not been recorded before for Mid-Yorkshire. A specimen of *A. subfuscus* (type) was found by me in Foundry Lane a few years ago and recorded in above Monograph. Last year I found a specimen at Adel Dam, near Leeds, in the same locality where I found a specimen three years ago.—W. HARRISON HUTTON.

P.S.—The above specimen and variety have been submitted to Mr. J. W. Taylor and verified by him.

PLANORBIS (GYRAULUS) ACRONICUS Férussac
AT OXFORD.

By A. E. ELLIS.

(Read before the Society, December 3rd, 1924).

ON looking over a number of shells collected on May 21st, 1922, in a branch of the R. Thames flowing by the west side of Pixey Mead, along the Berkshire border, just above Godstow, Oxford, I find that those that I had assigned to *Planorbis albus* Müller are really the form known as *P. stræmi* Westerlund, = *P. acronicus* Férussac (see *Proc. Malac. Soc.*, xvi, no. 1), = *P. deformis* (Férussac) Hartmann, which agrees with the description of *P. albus* var. *draparnaldi* in "British Conchology" (vol. I, p. 84): "Shell more closely and sharply striate in the line of growth: *periphery* distinctly keeled: *umbilicus* deeper. *P. spirorbis*, Drap. Hist. Moll., p. 45, pl. ii, f. 8-10. *Helix draparnaudi*, Sheppard, in Linn. Tr., xiv, p. 158. *P. draparnaldi*, Jeffr. in Linn. Tr., xvi, p. 386." The species was living at Godstow on sunken wood and stones and on the under surface of water-lily leaves, in a rather rapidly flowing and gravelly portion of the stream. The somewhat jagged periostracal keel is prominent on the older shells, and they further differ noticeably from *P. albus* in being of a rather waxy horn-colour above, paler below with a faint greenish tinge, and in the whorls being more compact and gradually enlarging. Jeffreys records his var. *draparnaldi* from Holbrook in Suffolk (Sheppard), Cardiff, Bristol, Church Stretton in Salop, and Birmingham (Nelson). It is possible that some or all of these citations refer to a faintly carinate form of the true *P. albus* such as I have myself found at Welford, Northants, and in the R. Welland at Market Harborough; similar specimens are in my collection from Elstree, Middlesex (O. W. Richards) and the R. Ely, Cardiff (O. W. Richards); these last have a very distinct keel, and may be the same as Jeffreys' variety. Within more recent times *P. acronicus* has only been observed living in the Thames basin, where it is also a common Holocene fossil. Mr. L. Dawes has collected it in the R. Cherwell at Gosford Bridge, near Islip, Oxon., Mr. R. Winckworth in the R. Thames below Goring (*Journ. Conch.*, xvii, p. 77), and Mr. J. E. Cooper in the R. Thames at several places, e.g., Cookham, Bourne End, Marlow (*Journ. Conch.*, xvii, pp. 119-123; *Proc. Malac. Soc.*, xvi, p. 15). The species will probably be found to be quite generally distributed in the Thames and its tributaries, if not further afield. A description of the shell (as *Planorbis stræmi*) is to be found in E. W. Swanton's "Pocket Guide to the British Non-

Marine Mollusca," (Lockwood, 1906), p. 90. The shell is figured (type specimens) in *Proc. Malac. Soc.*, xvi, no. 1. Mr. Cooper suggests (*P. Mal. Soc.*, xvi, p. 15) that this may be the *P. carinatus* var. *disciformis* of Jeffreys ("British Conch.", I, p. 90), which is cited from "Bucks, Oxford, Cambridge, Glamorgan, Cork, and Tipperary," but the description, "Shell flatter and thinner, of a yellowish colour, having the last whorl larger in proportion to the others, and the keel more prominent and sharp and placed exactly in the middle," does not appear to indicate our shell.



Note on *Achatina fulica* Fér.—Reversed examples of *A. panthera* are not infrequent and in face of this I was surprised to see that Germain in "Faune Mal. des Iles Mascareignes" p. 188 states that the sinistral *Ach. fulica* recorded by Ancey in "Bull. scientifique France et Belgique," 1906, p. 190 is the only one known. Ancey's paper, however, is a bare list of known reversed species without references to sources of information and the item probably refers to *Ach. mauritiana* (= *fulica*) var. *sinistrosa* Grateloup (Actes Soc. Linn. Bordeaux, 1839, p. 415) which latter author adds that the specimen was collected in Madagascar by M. Duisabo. It would therefore appear worth recording that I possess a reversed specimen of *fulica* marked as from Mauritius which was given to me some years back by Mr. Robert Standen.—G. C. SPENCE (*Read before the Society*, Feb. 3rd, 1926).

HELIX DRAPARNAUDI Sheppard, and PLANORBIS
DRAPARNALDI Jeffreys.

By A. E. ELLIS.

(Read before the Society, February 4th, 1925).

SPECIMENS of *Planorbis albus* Müller, with a distinctly keeled shell, collected by Mr. O. W. Richards in the R. Ely, at Cardiff (to which I referred in a previous communication to the Society, on *Pl. acronicus* Fér.), have been identified by Mr. A. S. Kennard as var. *stelmachoeitia* Bourg. Now Jeffreys (*Linn. Trans.* XVI, 1833, p. 387) states that his *Pl. draparnaldi* was found "Sparingly among the rejectamenta of the river Taaf, near Cardiff. It somewhat resembles an overgrown specimen of the following [*Pl. albus*]; but differs in the disproportionate size and medial carina of the last volution." It seems, then, that Jeffreys' *Pl. draparnaldi* (*Pl. albus* var. *draparnaldi* of "British Conchology," I, p. 84) is referable to var. *stelmachoeitia* Bourguignat, and not, as has sometimes been held, to *Pl. stroemi* Westerlund (= *acronicus* Fér.), as *Pl. stroemi* is only known in Britain from the Thames Basin (all the localities cited by Jeffreys for var. *draparnaldi* are in other parts of the country), and as Jeffreys' description, save for the keel, does not indicate *Pl. stroemi*. With regard to this last feature, it is not enough to rely on the presence or absence of a keel to distinguish *Pl. stroemi* from *Pl. albus*, as it may be more or less obsolete in specimens of the former species, and quite pronounced in the latter. The gradually enlarging whorls (and hence comparatively smaller aperture), the absence of marked spiral (longitudinal) lines, and the colouring of the shell of *Pl. stroemi* appear to be its best diagnostic characters. Jeffreys, in a MS. note in his own copy of "British Conchology," makes his "*Pl. albus* v. *draparnaldi* = *Pl. borealis* Westerlund." As for "Helix 35 Draparnaudi (Planorbis, *Drap.* and *Lamarck*)" described by Rev. Revett Sheppard (*Linn. Trans.* XIV, p. 158), which Jeffreys cites in his synonymy, this, from the description, "Shell $\frac{1}{4}$ -inch in diameter, grey above, whitish below, somewhat shiny; whorls 4, the last, in the middle near the aperture, subcarinate. Aperture dilated" (translated), appears also to be a form of *Pl. albus*; the author himself says, "This shell, of which I have taken two specimens in Holbrook mill-pond, is of nearly the same shape with *H. alba*" [*Pl. albus* Müll.]. Unfortunately the shells of *H. draparnaudi* are not in Sheppard's collection, which Mr. Kennard has; there can, however, be little doubt that he was describing the keeled form of *Pl. albus* (which Mr. Kennard refers to var. *stelmachoeitia* Bourg.), and this should therefore be known as *Planorbis* (*Gyraulus*) *albus* Müller, var. *draparnaudi* Sheppard, *Linn. Trans.* XIV, p. 149 (1825) [= *Pl. draparnaldi* Jeffreys; non *Pl. spirorbis* Drap., nec *stroemi* West.].

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND

543rd Meeting, held at the Manchester Museum, January 6th, 1926.

Mr. G. C. Spence in the chair.

New Members Elected.

R. T. Millott.

Sohtsu G. King.

Candidates Proposed for Membership.

Pieter De Bruyne, British Vice-Consul, Middelburg, Rouaansche Kade, G. 150 (introduced by J. R. le B. Tomlin and G. C. Spence).

Philip Pomeroy Milman, Cyprina, Lower Conway Road, Paignton (introduced by H. C. Fulton and J. W. Jackson).

Resignations.

Prof. S. J. Hickson.

R. H. Bentley.

Members Deceased.

Jacques Savès.

Frank Morey.

Members Struck off the List.

The names of three members were read out as having been struck off the List in accordance with Rule IV, in consequence of non-payment of arrears of subscriptions.

Papers Read.

"The Freshwater Mollusca of Sale Meadows, Cheshire," by H. de W. Marriott.

"Further Observations on the local variation of *Clausilia bidentata*," by Prof. A. E. Boycott.

"British Marine Census: Recorder's Notes," by R. Winckworth.

"On the Nomenclature of certain British Mollusca, and the Description of a new species of *Emarginula*," by J. D. Dean.

Exhibits.

By Mr. A. K. Lawson:—Specimens to illustrate Mr. Marriott's paper.

By the Rev. L. W. Grensted:—*Pisidia* (about 30 spp. from North America, Australia, Tasmania, and New Zealand; *Physa acuta*, from Botanic Gardens, Oxford; *Helicella heripensis* and *caperata*, also *H. hortensis* var. *olivacea* (a very dark form), from Hall-road Sandhills, S. Lancs.

The special exhibit was Jamaican Land Shells.

544th Meeting, held at the Manchester Museum, February 3rd, 1926.

Mr. G. C. Spence in the chair.

New Members Elected.

Pieter De Bruyne.

P. P. Milman.

Member Deceased.

R. Bullen Newton.

A vote of condolence was passed unanimously.

Papers Read.

"*Sphaerium pallidum* (Gray) in Oxfordshire," by the Rev. L. W. Grensted.

"Note on *Achatina fulica* Fér." by G. C. Spence.

Exhibits.

By Mr. G. C. Spence: Specimens to illustrate his note.

By Mr. M. Southern (a visitor): Opalised shells from Queensland.

The Special Exhibit was *Achatinella*.

545th Meeting, held at the Manchester Museum, March 3rd, 1926.

Mr. G. C. Spence in the chair.

Addition to Library announced and Thanks voted :

A handsomely bound copy of "A Monograph of the the British Nudibranchiate Mollusca," by Joshua Alder and Albany Hancock (presented by George Sich).

Members Deceased.

Dr. W. E. Hoyle

W. H. Heathcote.

Votes of condolence with the relatives were passed unanimously.

Paper Read.

"Some rare molluscs from the neighbourhood of Borås," by Berthold Sundler.

Exhibits.

By Mr. G. C. Spence:—Species of *Diplommatina*.

By Mr. J. W. Jackson:—*Stenogyra* (*Rumina*) *decollata*, *Pomatias elegans*, *Helix aspersa*, *H. aperta*, *H. cespitum*, and *H. terrestris* var. *grisea*, collected at Cimiez, Nice, by Prof. O. T. Jones, of Manchester University, Jan. 1926.

The Special Exhibit was "Madeiran Land Shells."

546th Meeting, held at the Manchester Museum, April 10th, 1926.

Mr. G. C. Spence in the chair.

Member Deceased.

J. W. Boulton.

Exhibits.

By Mrs. Gill:—Large series of *Mitra*.

By Mr. G. C. Spence (on behalf of Mr. Frank Collier):—*Polymita picta* (Born), from Cuba, and *Liguus virgineus* (L.) from West Indies, both figured, from the Edward Collier collection, in Taylor's "Monograph," Vol. i., pl. ii., f. 8-9. (These two specimens have been presented to the Manchester Museum by Mr. Frank Collier).

The Special Exhibit was *Helicarion*.

547th Meeting, held at the Manchester Museum, May 1st, 1926.

Mr. J. W. Taylor (President) in the chair.

Donation to Library announced and thanks voted :

"The British Nudibranchiate Mollusca," by Joshua Alder and Albany Hancock, part viii (supplementary), by Sir Charles Eliot (presented by George Sich).

"Manual of Conchology," part 108 (presented by Dr. H. A. Pilsbry).

Candidate Proposed for Membership.

W. J. Clench, Kent Scientific Museum, Grand Rapids, Michigan, U.S.A. (introduced by J. R. le B. Tomlin and J. W. Jackson).

Resignation.

V. Howard.

Member Deceased.

K. I. Anderson.

Exhibits.

By Mr. A. K. Lawson:—Eroded *Limnæa stagnalis* from pond near Ashley Mill, Cheshire.

By Mr. J. W. Jackson:—(1) A selection of the "Edward Collier" Land Operculates, recently presented to the Manchester Museum by Mr. Frank Collier. (2) A selection from a large series of South African shells, presented to the Museum by Mr. A. Butt and Mr. H. C. Burnup. Among the shells exhibited were *Voluta* (*Alcithoe*) *ponsonbyi*, Smith, Durban; *Eugyrina gemmifera*, Euthyme, Port Shepstone; *Septa costata*, Born, Umkomaas; *Achatina zebra* Lam., East London; *A. burnupi*, Smith, East London; *Metachatina kraussi*, Reeve, Zululand; *Natalina* (*Aerope*) *caffra* (Fér.), East London; and *Sculptaria sculpturata* (Gray), Usakos.

The Special Exhibit was "Lord Howe Is. Shells."

SHELL POCKETS OF OXWICH DUNES.

By CAPT. H. E. QUICK.

(Read before the Society, November 4th, 1925).

At the southern end of Oxwich Bay on the south coast of the Gower peninsula a strip of sand-dunes lying north-east and south-west measures a mile and a quarter in length and averages four hundred yards in breadth. Inland the blown sand is bounded from N.E. to S.W. by

- (i) Salt marsh, $2\frac{1}{2}$ furlongs
- (ii) Brackish marsh, $2\frac{1}{2}$ furlongs
- (iii) Woodland, 2 furlongs
- (iv) Moist flat areas surrounded by bracken, with a few scattered clumps of trees, 3 furlongs.

On the sea-ward side the northern portion is sandy beach for 6 furlongs, and the southern portion consolidated shingle beach for 4 furlongs. A freshwater stream, draining a marsh, flows past the north end of the dunes and curves southwards on the beach.

It occurred to me that it would be interesting to compare the contents of shell pockets, taken at intervals from one end of the dunes to the other, with the known distribution of snails living in the area.

The samples were collected during June and July, 1925, from about the middle line of the strip of dunes, with the exception of sample G which was taken from the seaward slope at the south end.

	A N. End of Dunes 1 oz.	B S. of Salt Marsh 3 oz.	C S. of Brack'h Marsh 6 oz.	D S. of Wood 8 oz.	E S. of D. 4 oz.	F S. End of Dunes 1 oz.	G S. End of D'nes Seawa'd Slope 1 oz.
Pupa muscorum	8	40	105	277	70	0	1
Pupa cylindracea	2	12	49	104	37	2	0
Vertigo antivertigo	0	0	0	1	0	0	0
Vertigo pygmæa	0	1	4	11	7	0	0
Vertigo angustior	0	0	1	2	6	0	0
Punctum pygmæum	0	0	4	4	2	0	0
Phytia myosotis	1	1	5	4	4	0	0
Caecilioides acicula	0	0	0	0	0	0	5

From the method of collection, the larger species were mainly very young. The species identified were *Vitrina pellucida*, *Vitrea crystallina*, *Punctum pygmæum*, *H. virgata*, *H. caperata*, *H. barbara*, *Hygromia hispida*, *Acanthinula aculeata*, *Vallonia costata*, *V. eccentrica*, *H. aspersa*, *H. nemoralis*, *Cochlicopa lubrica*, *Caecilioides acicula*, *Pupa muscorum*, *P. cylindracea*, *Vertigo antivertigo*, *V. pygmæa*, *V. angustior*, *Clausilia bidentata*, *Carychium minimum*, *Phytia myosotis*, *Planorbis spirorbis*, *Paludestrina stagnalis*, *Littorina littorea*, *L. rudis*, *Rissoa parva*, *R. striata*, *Buccinum undatum*, *Purpura lapillus*, *Cylichna cylindracea*.

Eight species were selected for counting in each sample, viz.:—*Pupa muscorum*, *P. cylindracea*, *Vertigo antivertigo*, *V. pygmæa*, *V. angustior*, *Punctum pygmæum*, *Phytia myosotis*, and *Caecilioides acicula*. These were chosen as being on the whole about the same size, small and light and drifting easily, and also because in most cases the distribution of the living snails in the area was known, and in some cases definitely circumscribed.



The samples were sifted and spread in small quantities at a time on a black shallow rectangular dish, and the shells picked out by the aid of a binocular loupe with a moistened camel-hair brush, and distributed in watch glasses. The result is shown in the accompanying table, which should be read in conjunction with the sketch map. At each end of the dunes the pockets were few and poor, and the samples in consequence small, viz., about one ounce. The central

portions were richer. I have given the actual quantities approximately and the total numbers, and not reduced the numbers to those for one ounce uniformly, in order to retain whole numbers.

Young of *barbara*, *capitata* and *virgata* were abundant in all the samples; *lubrica* was abundant in B, C, D and E; *Vallonia* occurred in A, B, C, D, E and F; *Pal. stagnalis* occurred in A, B, C, D, E and F; *Rissoa striata* and *R. parva* in all.

One example of *Planorbis spirorbis*, and only two examples of *Clausilia bidentata* occurred.

As to the eight species counted :—

Pupa muscorum occurs living abundantly all over the dunes in the marshy areas and under stray logs and stones in the bracken, and is also relatively abundant in all the samples except F and G.

P. cylindracea also occurs abundantly in the drier sites, and, roughly speaking, varies with *muscorum* in the samples.

V. antivertigo is abundant in the fresher portion of the marsh, and within 100 yards of B, and yet only one specimen was found, viz., in D. It is scarce or absent from the remainder of the area.

V. pygmæa occurs on the edges of damp hollows, surrounded by bracken in the southern third of the dune area, and is not accompanied by *antivertigo*. It is very scarce or absent (none found) in the *antivertigo* area further north. In the samples it is scarce or absent in A, B, F and G, and occurs in C, D and E.

These facts show very clearly that wind carriage from the south and west is responsible for the accumulation of land shells in the pockets, and that there is practically no drift from the north.

Vertigo angustior has not been found living, but some of the pocket shells look remarkably recent, and from the association in the tables it would be expected to occur in the *pygmæa* areas.

Punctum pygmæum occurs in the *V. pygmæa* areas, and accompanies it in the samples.

Phytia myosotis is abundant on the edges of the salt marsh and on the banks of the stream draining the mere, and yet is scarce in samples A and B which are nearest its site, and more abundant in C, D and E. It does not live in the southern end of the area. Its occurrence in the samples in conjunction with the virtual absence of *antivertigo* points strongly to the conclusion that it is carried by the stream and tides to the beach and then southwards, and is afterwards blown on to the dunes by southerly winds with the marine species found there.

Caecilioides acicula. The five specimens in the small sample G were quite unexpected. I have very little doubt, however, that they were washed out of the cliff below the church two hundred yards to the south of the site G, and afford a striking instance of water and wind carriage from south to north.

Marine shells were present in this sample, but very few dune shells.

The great majority of the pocket shells is easily derivable from the living shells of the area, but repeated search at all times of the year has failed to find *H. barbara* living, though it is one of the most abundant in the pockets. *V. angustior* also has not been found living, but it is small, and if the sites were limited it could be overlooked.

The virtual absence of *Clausilia bidentata* from the pockets is striking, only two being found in all the samples, though it is abundant living, with *P. cylindracea* and *P. muscorum*. It is a comparatively heavy shell, and does not drift in the wind nearly as well as the Pupas and Vertigos, or even half-grown *virgata*, *hispida*, *nemoralis*, &c., as can easily be seen by putting a mixed handful of shells on a table and blowing on them. This may be the explanation.

EDITORIAL NOTES.

NINETEEN HUNDRED AND TWENTY-SIX brings with it the Jubilee of the Conchological Society. The first official notice, headed "The Conchological Club, Leeds," appeared in this Journal, vol. I., p. 185, and announced "the successful establishment of a working Conchological Club in Leeds," with fortnightly meetings throughout the year, and stated the objects of the Club on broad and comprehensive lines. In vol. II., p. 178, appeared the first instalment of Proceedings, and the Club had meanwhile changed its title to The Conchological Society of Great Britain and Ireland.

We must congratulate Mr. H. McClelland and ourselves alike on the completion and issue of his General Index to the 4 serials which have been devoted exclusively to Conchology and Malacology in this country. With great generosity he has presented a copy to each member of this Society, as a sort of extra number of the Journal, and further copies are procurable as advertised on the cover of this number. In such an onerous and trying piece of work it is inevitable that mistakes should occur. Mr. McClelland will be very grateful if anyone detecting an error of any kind will send a postcard either to him or to the "Journal of Conchology," reporting the fact.

Attention may be drawn to a paper by Lt.-Col. Peile in the Proceedings of the Malacological Society (London) vol. XVI., pp. 195-7 on the differentiation of the spotted and unspotted British Trivias as distinct species. The criteria given are based mainly on the radulae, but differences may also be detected in the dorsal ribbing. The correct name for the spotted species is said to be *T. monacha* (da Costa) and for the unspotted, *T. arctica* (Montagu). I may say that a very lengthy acquaintance

with living *Trivias* between tidemarks in the Channel Isles has revealed no difference in habitat or association. As recently as last September I found both forms living side by side on the underside of the same stones, on the purplish *Botryllus*.

Two Natural History journals have unfortunately ceased publication within the last year or two, viz., the "Irish Naturalist," and the "Lancashire and Cheshire Naturalist," but we rejoice to say that in either case a new magazine has arisen phoenix-like from their ashes. The "Irish Naturalists' Journal" first appeared, under excellent auspices, in September of last year, and is edited by J. A. S. Stendall, with sectional editors in Botany, Zoology, Geology, Antiquities and Ethnology. Hon. Sec.'s name and address: W. M. Crawford, B.A., Orissa, Marlborough Park, Belfast, to whom all enquiries may be addressed. The Journal appears every two months and the annual subscription is 6/-, post free. It is the official organ of five important Irish Societies and Field Clubs.

The "North-Western Naturalist" issued its first number last March, under the editorship of A. A. Dallman, F.C.S., with seven specialists as collaborators. The contents of Nos. 1 and 2 provide an admirable and varied bill of fare, including a paper by Prof. Boycott, on "A Green Alga Parasitic in a water-snail" (*L. peregra*). Obituary notices have appeared of Dr. Hoyle and of W. H. Heathcote. All business communications should be addressed to F. H. Green, 86, Old Chester Road, Woodhey, Rock Ferry.

The Memoirs of the Indian Museum, vol. VIII., pp. 91-152, contain an exhaustive account of the anatomy of *Pila globosa* (Sw.), with 3 plates, by Dr. B. Prashad.

Dr. Prashad has examined the types of eight species of freshwater molluscs collected by the "Vega" expedition in Ceylon and described as new by Westerlund in 1885. Three of these have been omitted from the Fauna of Brit. India Freshwater Mollusca. All eight prove to belong to already known species. Prashad's Paper is published in Rec. Ind. Mus., XXVII., pp. 345-350. This volume of the Records also contains a most useful Revision of the Recent Indian Limnæidæ (pp. 137-189) with very many text figures of shells, radulæ and anatomical details, by Annandale and Rao. As *L. stagnalis*, *L. lagotis*, *L. auricularia* and *L. truncatula* are all recognised as occurring within the limits of the Indian Empire, this paper will be of great interest and assistance also in the study of palæarctic forms.

A correspondent draws my attention to some papers of great interest to students of Mollusca which appear in the XIIIth volume of the *Journal of the Marine Biological Association*.

In vol. xiii., part 1 (Dec. 1923), Dr. J. H. Orton gives an "Account of Investigations into the Causes of Unusual Mortality among Oysters in 1920 and 1921." A fuller report by Dr. Orton has since been published by the Ministry of Agriculture and Fisheries (Fishery Investigations, vol. 6. No. 3, 1923 [1924], 199 pp. and 12 plates), containing the results of valuable zoological research, especially on muscle pathology and the crystalline style.

A very important Paper by E. Ford discusses "Animal Communities of the Level Sea-Bottom in the Waters adjacent to Plymouth," which should be read by all who are interested in British Marine Mollusca. The quantitative work carried out in this connexion provided so much valuable information on the life history of lamellibranchs, that the accumulated material was re-examined and the results embodied in a Paper in vol. xiii., part 3 (March, 1925), "On the Growth of some Lamellibranchs..."

In part 2 (Nov., 1924), Dr. T. A. Stephenson discusses the life history, habits and economics of the Ormer in "Notes on *Haliotis tuberculata*."

In part 4 (Oct., 1925), Dr. C. M. Young gives an account of "The Hydrogen Ion Concentration in the Gut of certain Lamellibranchs and Gastropods," which throws new light on the crystalline style. In the same number is a short and interesting account of the rediscovery of the marine pulmonate *Onchidella celtica* on our shores. It was found in some numbers in Fistral Bay, New Quay, on an island rock entirely submerged at high tide. They live in holes and crevices and come out an hour to an hour and a half after high tide to seek the small algæ on which they feed. Mr. Russell considers that the coast of Brittany is its main locus of distribution.

Abstracts of memoirs summarize work done on *Teredo* (Harrington : Potts : Barger : Yonge), parasites on Chitons (Debaisieux), *Anomia* (Winckworth), the habitats of *Limnæa truncatula* and *L. pereger* (Atkins and Lebour).

SYNONYMY OF THE BRITISH NON-MARINE MOLLUSCA.—Compiled and annotated by A. S. Kennard and B. B. Woodward. London : printed by order of the Trustees of the British Museum. March 1926. Not priced.

The appearance of Messrs. Kennard and Woodward's Synonymy will be welcomed by all who are interested in British Non-Marine Mollusca. It represents a vast amount of careful research both among literature and specimens, and will do much to help toward that desired end, the stabilisation of names. The early literature has been so thoroughly searched, that we may feel almost secure from further surprises in that direction, and the identity of the species described has been as far as possible fully investigated as we know from various papers in the Malacological Society Proceedings, where the authors have given their reasons at length for the nomenclature adopted in various groups. A gratifying feature of the work is the inclusion of pleistocene and holocene records ; this is to be expected since Mr. Kennard is a prominent member of the Geological Society, and has made this study specially his own.

Of more doubtful value is the inclusion (pp. 346-361) of 16 exotic introductions. Frankly I do not see what purpose this list serves, especially as it includes various tropical species from greenhouses. Exotics that have become definitely established like *Physa acuta* Drap. might well have been included in the British list, as has indeed been done in the case of *Planorbis dilatatus*, Gould, and a few others. But the record of *Helicodiscus parallelus* (Say) from hot-houses in Cork, for example, seems to me of no greater (and no less) interest than the breeding of *Felis leo* L. in Dublin, or of *Attacus atlas* L. in Brighton. Further the list is incomplete and might have been increased by the addition of many other species that have been introduced accidentally and flourished a longer or shorter time.

The work of Mr. Kennard I know to be so thorough, and his judgment so careful, that it is with the uneasy feeling he must be right I venture to offer any adverse criticism of his views. Perhaps he will solve my doubts by replying in detail to the few cases in which I do not recognize the validity of the names he advocates.

The meaning of *Helicella* has been much discussed recently.¹ The question is a difficult piece of nomenclatorial casuistry which need not be fully discussed here : but a careful review of the literature and of the arguments put forward by the authors noted makes it clear that the name must be used for the group of which *H. ericetorum*

¹ See Gude and Woodward, Proc. Malac. Soc. xiv. 174 (1921) : Gude and Woodward, Ann. Mag. iii. 624 (1921) : Pilsbry, Proc. Malac. Soc. xv. 39 (1922) : and Watson, J. Conch. xvi. 277 (1922).

Müller is genotype. This view is very clearly put forward by Pilsbry and by Watson. The latter paper appears to have escaped the authors' notice, or they would not have preferred *Fruticicola* to *Hygromia* on p. 234.

On p. 18 *Hydrobia* is rejected on account of a prior *Hydrobius*. Such rejections have been much in vogue lately, but are not in accordance with the International Rules of Zoological Nomenclature. I quote Art. 26 Rec.—“It is well to avoid the introduction of new generic names which differ from generic names already in use only in termination or in a slight variation in spelling which might lead to confusion. But when once introduced are not to be rejected on this account. Examples: *Picus*, *Pica*.....” The same point is raised in Opinion 86, where it is decided that “*Conulinus*, von Martens, 1895 is not invalidated by *Conulina*, Bronn, 1835.” Accordingly *Hydrobia* stands for the genus they call *Paludestrina*.

On p. 32 some indication of the invalidity of *Syncera* should be given, since it antedates *Assimineæ* by seven years. Iredale shows that it may be regarded as a *nomen nudum* (Proc. Malac. Soc. xv. 37, 1922).

The omission of *Clausilia cravenensis* Taylor is the only serious error of omission in the work. It should at least appear in the synonymy of *C. dubia* p. 272. My own opinion is that the British form, excluding the Dover examples (presumably an introduction), should stand as a distinct species with Taylor's name *cravenensis*, on both conchological and geographical grounds. I hope that someone who has the necessary material will take up the question anatomically.

In the *Pisidia* Mr. Woodward appears to have rested on his laurels: to him we owe the valuable Catalogue of 1913, which has done so much to elucidate our British species. But the excellent more recent work of Messrs. Stelfox, Oldham and Phillips seems to have been almost completely ignored; and it is a great pity that references to various recent papers by Odhner have not been included. In Proc. Malac. Soc. xiv. 209/220 Mr. Woodward offered remarks on some of the points at issue: but the experience of workers in this group has during the last five years supported the views of “Mr. C. Oldham and other British Authorities.”

I see no reason to reject Poli's specific name *casertanum*, assuming Woodward's identification of it on somewhat slender evidence to be correct. Poli is strictly binomial wherever he names species: the only question at issue with regard to Poli is the value of some of his generic names. Like Linnæus and many of the older authors he gives different generic names to the shell and the animal: and further elaborates his system by inventing new names in derma for shells having a special type of inhabitant. The reasonable course, it seems to me, is to accept Poli's species, and both his shell and soft-part names e.g. *Anomia* and *Echion*, but to reject *Echionoderma*, regarding the latter as a zoological term rather than a generic name: but I admit it would be well to submit the point to the International Committee for a ruling. We accept for example both generic names in Linnæus' “*Argonauta* Animal Sepia” and “*Helix* Animal Limax,” taking the types of Sepia and Limax from the earlier entries.

To return to *Pisidium*, I should list our recent British species as:—

PISIDIUM Pfeiffer.

- P. amnicum* (Müller)
- P. pulchellum* Jenyns
- P. casertanum* (Poli) = *cinereum* Alder
- P. nitidum* Jenyns = *pusillulum* Woodward (probably)
- P. milium* Held
- P. obtusalastrum* Woodward (should not this be *globulosum* or *scholtzii*?)
- P. gassiesianum* Dupuy = *personatum* Malm = *pusillum* Jenyns

PISIDIUM Pfeiffer.

P. subtruncatum Malm*P. lilljeborgii* Clessin*P. henslowanum* (Sheppard)*P. supinum* Schmidt

Subgenus NEOPISIDIUM Odhner

P. moitessierianum Paladilhe = *torquatum* Stelfox = *parvulum* Woodward (olim) and Stelfox (olim)*P. hibernicum* Westerlund = *parvulum* Clessin*P. tenuilineatum* Stelfox

In a review of this kind one is naturally prone to emphasise the points in which one differs from the authors. In conclusion then let me once more insist on the great value of this work, which summarizes the careful research of many years, and is invaluable to every systematic worker on our non-marine mollusca.

R.W.

BRITISH SNAILS, A GUIDE TO THE NON-MARINE GASTROPODA OF GREAT BRITAIN AND IRELAND, PLIOCENE TO RECENT. By A. E. Ellis, with illustrations by R. A. Ellis. Oxford: Clarendon Press, 1926. Price 10s.

The author of this book is to be congratulated on having produced the most satisfactory handbook on our land and fresh water gastropods, that has yet appeared. He has remarkable breadth of outlook and every aspect of his subject has been touched upon, even if lightly; but this restraint was necessary to keep the book within a small compass. The 33 introductory pages are excellent reading and merit close attention: the systematic part more than satisfactory. He is clear in description, and the figures are thoroughly good, quite the best of any that I have seen: Mr. Ellis, senior, has certainly nearly touched perfection here, and even the Planorbis, notoriously difficult, have yielded to his treatment: these figures combine the accuracy of photography with the clearness of diagrams: and the engravers using 150 screen have been successful in reproduction: two figures only out of over 300 (*Ancylus* and *Ancylastrum*) fall below the high standard.

The nomenclature has clearly received careful attention, and may safely be followed almost throughout. There seems no reason however for altering *Sabinea* to *Sabanæa* (p. 47): on p. 51 *Testacella haliotoides* Lamarck should be preferred to *T. maugei* Férussac (v. Kennard and Woodward in Proc. Malac. Soc. xiv. 77): I am also of opinion that *Clausilia cravenensis* is preferable to *C. dubia* for the British snail (p. 55). I do not think the emendation of *Aplexa* to *Aplecta* or *Oncidella* to *Oncidiella* is justifiable, but that is a very small matter.

I should like to have seen descriptions and figures of the 'jaws' of *Arion* and *Limax*, inasmuch as they are easily examined and form a valuable aid to diagnosis: but no one should mistake the species from the descriptions given.

The more one uses the book, the more its value appears: and I recommend it confidently to the general naturalist as well as to the student of mollusca.

R.W.

Paludestrina jenkinsi at Borth.—The way in which this species gradually spreads over the entire county seems to me a perfect mystery. On 11th August, 1926, I dredged in a small pool on the Borth Golf Links and took a number of *P. jenkinsi* together with *Planorbis spirorbis*, *Pisidium casertanum*, *P. nitidum*, and *P. subtruncatum*. I dredged this pool a few years ago, when I am certain there was no *P. jenkinsi*, but I found plenty of the other species. I have to thank Mr. C. Oldham for kindly verifying the different species for me.—JOHN WILLIAMS VAUGHAN.

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JANUARY, 1927.

[No. 3.

Rec'd Jan 19/27

THE
JOURNAL
OF
CONCHOLOGY.

FOUNDED 1874.

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VOL. 18.

JANUARY, 1927.

No. 3

HISTORY OF THE CONCHOLOGICAL SOCIETY.

By J. WILFRID JACKSON, M.Sc., F.G.S.

(Read before the Society, October 16th, 1926).

THE SOCIETY owes its origin to a band of four enthusiastic and able conchologists resident in Leeds, viz., Messrs. J. W. Taylor, W. Nelson, H. Crowther, and W. Denison Roebuck, who, at a meeting held on the 12th of October, 1876, at the residence of Mr. Nelson, founded "The Conchological Club, Leeds." The aims and objects of the Club were the advancement of conchological science by the exhibition of specimens and the communication of information relating to every department of the science.

Mr. Nelson was elected as the first President, and Mr. Roebuck acted in the capacity of Secretary.

The formation of this club did not, however, come about in a spontaneous manner, but was the direct result of the publication of the Quarterly Journal of Conchology, which had been established by Mr. Taylor, with the assistance of Mr. Nelson, some two years previously, viz. February, 1874, for the purpose of popularising and extending the study of conchology, and to bring into closer relationship and friendship the few scattered conchologists of that period.

For the first eight years meetings were held mainly at the residences of the more prominent members, but in June, 1884, communications were opened with the Committee of the Leeds Mechanics Institute for the use of one of their rooms. Arrangements were duly made and the first meeting on the new premises was held in July, 1884. Meetings were held there until the end of 1887 when they were transferred to the Philosophical Hall, Park Row, Leeds.

In its early stages the Club's activities were specially devoted to the critical examination and recording of the non-marine shells of Yorkshire, and the idea of a National Society does not appear to have been entertained. The geographical distribution of shells—both marine and non-marine—outside the county and abroad was not neglected, however, and many interesting exhibits and discussions were held.

On December 7th, 1876, the Club joined the Yorkshire Naturalists Union, and has maintained its connection ever since.

After running for just over twelve months the Club found itself in a position to consider the advisability of re-organisation on broader lines and to commence the formation of a collection and a library. Preliminary discussions were held, and at a meeting at Mr. Taylor's residence on November 1st, 1877, it was resolved that the Club (or Society, as it was then known) be called "The Conchological Society." The annual subscription was fixed at 10/6 for new members, and for original members, i.e. those elected prior to the meeting, at 5/-.

Mr. (afterwards Dr.) R. F. Scharff, who was elected a member of the Society on October 18th, 1877, and is, therefore, one of the surviving Original Members, was largely instrumental in bringing the re-organisation about, as he appears to have been the first member to make donations to the Society and thus raise the question of its constitution. In later years he presented and exhibited many interesting groups of shells, especially from Bordeaux, where he lived for a time.

On January 17th, 1878, it was resolved to adopt the Quarterly Journal of Conchology as the Organ of the Society, but it was not until June of the following year, when this periodical had changed its title to the Journal of Conchology, that the proceedings of the meetings began to appear.

The first Honorary Member of the Society, Dr. W. Kobelt, was elected on May 9th, 1878.

At the 39th Meeting of the Society, held on May 30th, 1878, some fifteen new rules for the better government of the Society were drawn up and adopted, the first rule being: "That the Society be called 'The Conchological Society of Great Britain and Ireland.'" At this meeting Mr. Nelson was elected the first President of the now more widely organised Society, Mr. Taylor took on the duties of Secretary, and Mr. Roebuck those of Treasurer.

Mr. Nelson was at that time actively engaged in the study of the genus *Limnæa* and communicated many notes on that group at meetings of the Society. Some years before the foundation of the Conchological Society, when he was an active member of the Birmingham Natural History and Microscopical Society he contributed a valuable paper on "The Limnæidæ of Birmingham." In November, 1892, he was unanimously elected the first British Honorary Member of our Society. It is interesting to note that his valuable conchological collections and library are housed in the Leeds University, having been purchased by subscription and presented to that Institution as a permanent memorial.

In 1881 the Society adopted a scheme, put forward with much vigour by Mr. W. Denison Roebuck, for an Authenticated Census of British Non-Marine Mollusca. This project was an adaptation of Mr. Watson's celebrated system of botanical records and had for its object the systematic compilation of verified records of all the British species. Nobody was more fitted to carry out this great work than Mr. Roebuck, gifted by nature and instinct as a bibliographer and statistician, and an accurate recorder of his own captures and observations. The system was carried on by Mr. Roebuck's personal effort for nearly forty years, but death cut short his ambition to see the full publication of this stupendous undertaking..

A fairly complete census of our British species, with maps of their distribution, was issued by the Society as a Special "Roebuck Memorial Number" in June, 1921.

The above piece of work reflects great credit on the members of this Society, who, by their own individual efforts in collecting material for Mr. Roebuck, or in allowing access to their collections, contributed largely to make it a success. As already emphasized by Mr. J. W. Taylor, "the effect of this happily conceived scheme is that England now stands far ahead of any other country in the world for the precise and accurate knowledge of its non-marine mollusca, and it may also be affirmed that the knowledge of the precise distribution of this group in the British Isles is in advance of that relating to any other group of British animals, while it is highly probable that our information of the dispersal of our species in other countries is greater than is generally known by foreign scientists themselves."

Mr. Roebuck was responsible for the initiation of the modern study of slugs and was closely associated with Mr. Taylor in the inception of his Monograph. His Presidential year (1886) seems to have been a most active and prosperous one. Many new members were enrolled through the energy and public spirit of Roebuck's campaign in commending the Society to the favourable consideration of scientific men. Later, as the Secretary of the Society, especially during the years 1890-1893, Roebuck was the means of advertising the work of the Society by arranging for full reports of the meetings to be published in "The Yorkshire Weekly Post" and "The Leeds Mercury."

Roebuck was elected an Hon. Member of the Society on October 16th, 1915, and received the degree of Master of Science of Leeds University in July of the same year.

It is difficult within the limits of these pages to deal in an adequate manner with the influence exerted by Mr. J. W. Taylor upon the Society. From its very beginning he has stimulated and encouraged

the study of conchology, and more especially that of the life-history and distribution of British Non-Marine Mollusca. Among his early papers read to the Society and published in the Journal are two of particular interest dealing with the life-histories of *Helix aspersa* and *Helix arbustorum*. These two papers may be regarded as forerunners of the magnificent work to which he later devoted his life, viz. "The Monograph of the Land and Freshwater Mollusca of the British Isles"—a standard work on our recent and fossil Non-Marine Mollusca. The first part of this great work appeared in 1894, and its pages contain frequent references to and acknowledgments of the great assistance received from members of this Society. In addition to being elected President of the Society on more than one occasion, he was made one of its Honorary members on October 15th, 1910, and at a special meeting held on February 6th, 1915, on the attainment of his 70th birthday, he was presented with an Illuminated Address as a slight recognition of his valuable services. In July of the same year he received the Honorary Degree of Master of Science from the University of Leeds.

It is very desirable here that something should be said of the efforts of another Founder, Mr. Henry Crowther, in interesting the early members of the Society in the study of conchology. He made frequent use of the microscope in order to elucidate details in the structure of the Mollusca, and at the Society's Second Meeting, on October 26th, 1876, demonstrated by experiments the existence of a small quantity of phosphorus in the shell of the common edible mussel (*Mytilus edulis*). The presence of this had been denied by a leading conchologist, Dr. J. Gwyn Jeffreys (Brit. Conch., vol. I, p. xlv), but Mr. Crowther clearly proved its occurrence. At subsequent meetings Mr. Crowther demonstrated the anatomy of certain species, including *Anodonta cygnea*, *Sphærium corneum*, and *Mytilus edulis*. It is pleasant to record that Mr. Crowther was elected an Honorary Member on October 16th, 1920. He was President of the Society in 1924-25.

The presence in the Manchester district of a growing and vigorous body of conchologists, many of whom were members of the Conchological Society, led to the formation, in 1888, of the Manchester Conchological Society. This was accepted as an auxiliary Branch of the parent Society and had for its chief object the systematic investigation of the molluscan fauna of Lancashire, Cheshire, Derbyshire, and the portion of Yorkshire coming within twenty miles of Manchester. Mr. R. D. Darbishire was elected the first President, Mr. Robert Standen, Secretary, and Mr. Edward Collier, Treasurer. Later, Mr. Thomas Rogers was added as Referee and Authenticator.

Other conchologists present at the foundation of the new Society were Messrs. J. Ray Hardy, H. Hyde, W. H. Heathcote, and Charles Oldham, the last-named being the only surviving Founder.

From the time of its inauguration until July 1891 the winter monthly meetings of the Manchester Branch were held chiefly at 26 George Street, Manchester, but, on occasion, meetings took place elsewhere, four being at the residence of Mr. J. Cosmo Melvill, one at the rooms of the Manchester Literary and Philosophical Society and one (an Annual Meeting) at the Manchester Museum. From October 1891 the meetings took place regularly at the last Institution, permission having been kindly granted by the Authorities.

In the summer numerous successful excursions were made into the district around Manchester, and by this means very many records relating to the rarer forms of land and freshwater shells were obtained.

Like the Leeds Society, the Manchester Branch also held exhibitions and discussions on conchological subjects in general, and many of the papers read were published in the Journal.

For many years the reports of the monthly meetings appeared in full in the "Manchester City News," Mr. Standen supplying the information.

One of the most prominent students of foreign shells, both marine and non-marine, was Mr. R. D. Darbishire, a Manchester solicitor and an enthusiastic collector. Not only did he interest himself in the Manchester Branch, but often journeyed to Leeds in order to attend the Council Meetings of the Parent Society. On many occasions he was accompanied by Mr. J. Cosmo Melvill, another prominent member of the Manchester Branch.

Towards the end of 1894 proposals were considered for transferring to the Society the Journal of Conchology, which had been so ably edited and published by its founder, Mr. Taylor, for over twenty years. Arrangements were duly made and the goodwill, copyright and stock of back numbers were acquired from Mr. Taylor by purchase. The Journal then became the sole property of the Society and was issued under the direction of the Council by a Publication Committee with Dr. W. E. Hoyle as the Editor.

In May 1895, by the spontaneous initiative of the Leeds members, the question of the transference of the headquarters of the Society from Leeds to Manchester came up for consideration. Owing to the rapid growth of the Manchester Branch, it had been increasingly felt for some years that Leeds presented a narrower field of action and a less favourable position as the headquarters of the Society, compared with Manchester. But it was considered that any proposal for a change should emanate from the Leeds centre. Amicable arrange-

ments were duly entered into and Manchester became the chief executive centre of the Society. This transference led to the suspension of the Manchester Conchological Society as a Branch, while the Leeds centre took over this role.

From the above date onwards monthly meetings were held regularly at the Manchester Museum by the kind permission of the Authorities, and they also granted facilities for housing the Society's Library and Collections. These privileges, it is pleasant to record, are still enjoyed and appreciated. The close association of the Society with the Manchester Museum has been the means of making the collection of Mollusca in that Institution the most complete outside London.

Through contact with the Society, its Founders, and Presidents, members have devoted themselves to many different aspects of the study of conchology. Stimulated by Mr. Taylor's "Monograph" many have concentrated their efforts on elucidating the distribution of the Non-Marine Mollusca in a variety of places. Others, favourably placed as regards the seaboard, or in a position to make frequent visits thereto, have devoted their available time to the collection and study of the marine forms of British waters. Others again have been attracted to the study of the geographical distribution of foreign species, and in consequence have added very materially to our knowledge of both the marine and non-marine forms. The ecology, or the relation of mollusca to their habitats, has also received special attention: so too have their history (both past and present) and methods of reproduction.

Following Nelson, the first President (who was retained in office for four years), came other Presidents, each of whom furthered the interests of the Society and rendered good service to the science of conchology. Among those who have passed from us may be mentioned: W. Cash, Sylvanus Hanley, E. A. Smith, W. D. Roebuck, Rev. R. Boog Watson, P. B. Mason, Dr. W. E. Hoyle. Dr. G. W. Chaster, Lt.Col. H. H. Godwin-Austen, A. Somerville, Canon A. Merle Norman, Canon Horsley, R. B. Newton, R. Standen and Professor Gwatkin.

In addition to Leeds Branch, the Society has flourishing Branches in London and North Staffs.



Paludestrina jenkinsi on Skomer Island.—In June, 1926, I collected a few specimens of this species on Skomer Island, Pembrokeshire. Possibly it is quite a recent immigrant, for, in spite of a search in all likely places, I found it only in one, the overflow from a small spring, whereas on the neighbouring island of Skokholm in 1925 it was found in every little runnel (*antea* p. 17).—CHAS. OLDHAM (*Read before the Society*, Nov. 3rd, 1926).

LIST OF MOLLUSCAN PAPERS (mostly dealing with the order
Cephalopoda) by the late Dr. W. EVANS HOYLE, D.Sc., F.R.S.E.

ARRANGED BY J. C. MELVILL, D.Sc.

- 1883—On a new species of *Octopus*. P. Phys. Soc., Edinburgh, vii, pp. 319-322, pl. vi.
N.B.—Hoyle edited "Mollusca," 1885-8, in Zool. Record.
- 1885—On *Loligopsis* and some other genera. P. Phys. Soc., Edinb., viii, pp. 313-333. Abstr.: J. R. Microsc. Soc. (2) v. p. 984.
Note on *Loligo forbesii* Steenstrup, the so-called *L. vulgaris* of Gt. Britain's coasts. T.c. pp. 459-462.
Diagnoses of new species of *Cephalopoda*, collected during the cruise of H.M.S. "Challenger." Part 1, "*Octopoda*." Ann. Nat. Hist. (5) xv., pp. 222-236.
Ditto. Part ii, "*Decapoda*." Op. cit., xvi, pp. 181-203.
Preliminary Report on the *Cephalopoda* collected during the cruise of H.M.S. "Challenger." Pt. 1, *Octopoda*. P. Royal Soc. Edinb., xii, pp. 94-114.
Ditto. Pt. ii, "*Decapoda*." T.c., pp. 281-310.
Notes on the *Cephalopoda*, "Challenger" Narrative, pp. 269-274, figs. 106-109.
- 1886—Report on the *Cephalopoda* collected by H.M.S. "Challenger" during 1873-1876. Zool. Chall. Exped.: xvi, p. xlv, 246 pp., 33 plates, and map [n.spp., Zool. Rec. xxii, Mollusca, pp. 60-63].
On the existence of *Cephalopoda* in the Deep Sea. Report Brit. Assn., 1885, p. 1064.
Notes on the *Cephalopoda* collected by the L.M.B.C. during the summer of 1885 [1st Report Fauna, Liverpool Bay, pp. 278-280; also P. Liverpool Soc. xl, Appendix].
A. catalogue of recent *Cephalopoda*. P. Phys. Soc. Edinb., ix, pp. 205-267. [Also separately, Edinburgh, 1886, 8vo.].
- 1887—List of Shells collected by Mr. John Rattray, B.Sc., F.R.S.E., on the W. Coast of Africa and the adjacent Islands. P. R. Phys. Soc. Edinb. ix, pp. 337-341.
Additional note on the genus *Cuma*. J. of Conch., v, p. 209.
- 1888—Note on the Hectocotylisation of the *Cephalopoda*. Rep. Brit. Assn., 1887, p. 768.
Report on the Biological Investigations carried on into the West of I. of Lewis, in July and August, 1887. Rep. Fisheries, Scot., vi, pt. iii, pp. 215-222, pl. xv.

- 1889—Observations on the Anatomy of a rare Cephalopod (*Gonatus fabricii*). P.Z.S., 1889, pp. 117-135, pls. xiii and xiv. [Account of the anatomy: Funnel organ is probably a valve for closure of funnel. A table of the relations to *Onychoteuthis* and *Enoploteuthis*. Subfamily *Gonatidæ* established].
On a tract of modified Epithelium in the Embryo of Sepia. P. Phys. Soc. Edinb., x, pp. 58-60. Woodcut. [A trifid patch on posterior aspect of body; probably glandular].
On the Deep-water Fauna of the Clyde Sea-area. J. Linn. Soc., xx, pp. 442-472, map. [Faunal lists].
- 1891—Notes on a British Cephalopod, *Illex eblanæ* (Ball). J. Mar. Biol. Assn. (n.s.), ii, pp. 189-192, figs. [Abstract in J. R. Microscop. Soc. p. 22. 1892].
- 1894—On the luminous organs of *Cephalopoda*. Rep. Brit. Assn. 1893 (1894), pp. 802-803.
- 1895—Results of the "Challenger" Expedition. *Cephalopoda*. Nat. Sci., vii, pp. 63-64, fig.
- 1897—A catalogue of recent *Cephalopoda*. Supplement, 1887-1896. P. Phys. Soc. Edinb., xii, pp. 363-375.
Obituary Notice of David Robertson, L.L.D. J. Conch., viii, p. 329.
- 1901—Note on D'Orbigny's figure of *Onychoteuthis dussumieri*. Mem. Manchester Soc., xlv, No. 4, pp. 3.
On the generic names *Octopus*, *Eledone*, and *Histiopsis*. T.c., No. 9, 7 pp.
On a New Species of Sepia and other shells collected by Dr. Koettlitz in Somaliland (in collaboration with Robert Standen). Manch. Memoirs, vol. xlv., No. 6.
Chaster, G. W., Melvill, J. C., Knight, G. A. F., and Hoyle, W. E. List of British Marine Mollusca and Brachiopoda. J. Conch., x, pp. 9-27.
- 1902—The Luminous Organs of *Pterygioteuthis margaritifera*, a Mediterranean Cephalopod. Mem. Manchester Soc., xlvi, No. 16, 14 pp.
British *Cephalopoda*: their nomenclature and classification. J. Conch., x, pp. 197-206.
Two points in Nomenclature:
 (i) *Cypriniadea* versus *Cyprina*.
 (ii) The genus *Antiopa*.
T.c., p. 214.
On an Intropallial Luminous Organ in the *Cephalopoda*. Congress Zool., 1901, p. 774.

- 1903—Notes on the Type Specimen of *Loligo eblanæ* Ball. Mem. Manch. Soc., xlvii, No. 9, 10 pp., 1 pl. [Also issued as Notes, Manchester Museum, No. 14].
- 1904—A diagnostic key to the genera of recent *Dibranchiate Cephalopoda*. Mem. Manchester Soc., xlviii, No. 23, 20 pp. [Reprinted in Notes of Manchester Museum, No. 18].
- Sepia burnupi* n.sp. from Natal. J. Conch., xi, pp. 27-28, 1 pl.
- Reports on the *Cephalopoda*. U.S. Fish Commission, Steamer "Albatross" Expedition, 1891. Bulletin, Mus. Harvard, xliii, No. 1, 71 pp., 12 pls., 7 figs.
- On the *Cephalopoda*, in Report of Pearl Oyster Fisheries, of Gulf of Manaar. Pt. ii, Suppl. Rep. xiv, pp. 185-200, 3 plates.
- 1905—On specimens of *Tracheloteuthis* and *Cirrosteuthis*, from deep water off the West Coast of Ireland. Dept. of Agriculture, etc., for Ireland: Fisheries Branch: Scientific Investigations, 1902-03, No. 3, pp. 93-98, pl. 14.
- The *Cephalopoda* in: J. Stanley Gardiner, The Fauna and Geography of the Maldives and Laccadive Archipelagos, vol. ii, suppl. 1, pp. 975-988, pl. 95.
- 1906—Biscayan Plankton, Pt. viii, The *Cephalopoda*. Trans. Linn. Soc. Lond., x, 1906, pp. 159-162.
- The species of *Ctenopteryx*, a genus of *Dibranchiate Cephalopoda*. Manch. Soc. l., No. 14, 1906, 3 pp. [In collaboration with J. H. Ashworth].
- 1907—British National Antarctic Expedition, Nat. Hist. Reports, vol. 2. I. *Cephalopoda*.
- The Marine Fauna of Zanzibar and E. Africa, from collections made by Cyril Crossland in 1901-02. The *Cephalopoda*. Proc. Zool. Soc., London, 1907, pp. 450-461.
- Reports on the Marine Biology of the Sudanese Red Sea, vi. On the *Cephalopoda*. Journ. Linn Soc. Lond. Zoology, xxxi, 1907, pp. 35-43.
- Catalogue of the Library of the Conchological Society of Great Britain and Ireland. J. Conch., xii, No. 4, 1907, pp. 1-35.
- 1908—Presidential Address to Section D (Zoology) of the British Association. Rep. B. Assoc., lvii (Leicester, 1907), pp. 520-539.
- A Large Squid (*Stenoteuthis pteropus*) at Redcar, Yorks. Naturalist, 1908, pp. 132-133.
- 1909—A Catalogue of Recent *Cephalopoda*. Proc. R. Phys. Soc., Edinburgh xvii, 1909, pp. 254-299.

- 1910—A list of the generic names of *Dibranchiate Cephalopoda*, with their type species. Frankfurt-a.-Main, Abh. Senckenberg. Ges., xxxii, pp. 405-413.
Mollusca: *Cephalopoda*. Jena. Denkschr. Med. Ges., pp. 259-268, 1 Taf.
- 1911—Mollusca: *Cephalopoda* in National Antarctic Expedition, 1901-1904. London, 1907 (1-2).
- 1912—Ditto. Trans. Royal Soc., Edinb. 48, 1912, pp. 273-283.
Ditto. Scientific Results of the "Scotia" Expedition. T.c., pp. 91-102.
The luminous organs of some *Cephalopoda* from the Pacific Ocean. Proc. 7th International Congress, Cambridge, Mass., U.S.A., 1912, pp. 831-835.

NOTE:—

Lastly, I should like this opportunity of placing upon record that on February 12th, 1909, at my request (I being at that time President of the Caradoc and Severn Valley Club, whose Headquarters are Shrewsbury), Dr. Hoyle kindly consented to deliver a lecture, illustrated with lime light views, upon the famous career of Charles Robert Darwin, born at the Mount, near Shrewsbury, Feb. 12th, 1809. The meeting was held in the Music-Hall, and was largely attended. I took the chair, and the then Archdeacon of Salop (Ven. C. B. Maude) and Dr. Cyril Alington, then Head-master of Shrewsbury School, proposed and seconded a hearty vote of thanks to the lecturer, whose address was welcomed greatly, and was a most complete success from every point of view.



Helix nemoralis var. **rubella-fascialba** and var. **rubella-fascialba** 00300 in Staffordshire.—Mr. W. Hill, of Leek, was last year (1925) so fortunate as to discover a small colony of these interesting atavic varieties at Basford, Staffordshire. The var. *rubella-fascialba* is a reversion to a previously existent ancestral form, perceptibly different in its ornamentation from that now characterizing the species, and recalling the quite analogous variety *albocincta* of *Theba cantiana* and other similar species. The original pigmentation of the former spiral banding of the shell has become broken and diffused over the whole shell surface, except the more calcified and paler peripheral zone, which separates the upper and lower group of bands. The var. *rubella-fascialba* 00300 is identical with the preceding form, differing only by the presence of the median and more modern No. 3 band of the Pentatæniate formula, which has become superposed upon the paler peripheral space. This in its ancestral form constituted the separating area of the upper and lower group of bands or markings, and differs in being placed higher on the whorl than the corresponding space in the modern Pentatæniates and, therefore, the primitive peripheral space is not co-ordinate with the position in the modern Pentatæniates.—JOHN W. TAYLOR (*Read before the Society*, Dec. 1st, 1926).

TONNA (=DOLIUM) FASCIATA (Brug.),
with two pre-apertural varices; and Notes on other forms.

By J. WILFRID JACKSON, M.Sc., F.G.S. (MANCHESTER MUSEUM).

(Read before the Society, August 28th, 1926).

THE MANCHESTER MUSEUM possesses a specimen of *Tonna* (= *Dolium*) *fasciata* (Brug.), with two pre-apertural varices. The shell measures 73 by 54 mm., but is, unfortunately, without precise locality. It came with the R. D. Darbshire collection, and is registered E12175. One of the varices is fully half-a-whorl back from the present aperture; the other varix is about a quarter of a whorl back. Both stand out as strong ridges extending right down the body whorl, and are prominent internally. The present outer lip is slightly reflected, but has not yet received its final thickening.

The Museum collections also contain six more specimens, each exhibiting one pre-apertural varix. Four of these are unlocalised: the fifth is from Bombay (Abercrombie collection); the sixth is from Madras (Henderson collection). The last was referred to by Melvill and Standen in this Journal (vol. ix, April, 1898, p. 44).

The sizes of the above six specimens and the positions of the super-numerary varices relative to the present aperture are as follows:—

No. 1	78 by 58 mm.	Varix at	8 mm. along curve from outer lip.
No. 2	104 by 76 mm.	„	20 mm. „ „
No. 3	107 by 77 mm.	„	30 mm. „ „
No. 4	102 by 74 mm.	„	63 mm. „ „
No. 5	110 by 80 mm.	„	24 mm. „ „ (Bombay)
No. 6	84 by 61 mm.	„	22 mm. „ „ (Madras)

In addition to the above there are four normal examples of small size.

In 1910, H. B. Preston¹ figured a specimen of the above species with a pre-apertural varix as a new form under the name of *Dolium varicosum*. In 1919, the late E. W. Vredenburg² published the results of a study of the shells of this family and pointed out that the *Dolium varicosum* of Preston was undoubtedly the *D. fasciatum* (Brug.). At the same time he called attention to the presence in the Indian Museum of four more specimens exhibiting the same feature, and remarked that there is never more than one pre-apertural varix. The presence of two in the Manchester Museum specimen is therefore of some interest.

¹ Preston, Records of the Indian Museum, vol. v, 1910, p. 34.

² Vredenburg, Memoirs of the Indian Museum, vol. vii, no. 2, July, 1919, pp. 145-190, pl. ii-viii.

Vredenburg points out that normal specimens have been obtained along with varicose individuals, and the former often exceed the latter in size. It is a remarkable fact that whatever their size, the shells of this species invariably possess indications of a reflected outer lip, which in most cases is excessively thickened. From this it would seem to be clear that, as in other gastropods, the animal is able to absorb the apertural structures at each successive phase of growth. Vredenburg continues with the remark that the varicose specimens of the species discussed represent, therefore, individuals which, on approaching the final term of their growth, have lost the power of resorption; and, as the average size of these specimens is below that of the normally full-grown shell in which the supernumerary varix is absent, they probably represent individuals in which the vitality has been impaired through insufficient nutriment or some other cause.

Another feature in this species, not alluded to by Vredenburg, is the evanescence of the orange-brown bands on approaching the lip. In all but one of the Manchester Museum specimens with pre-apertural varices the banding ceases before reaching the varix (as in normal examples) and is not renewed during the post-varix growth. The one exception is the specimen with two pre-apertural varices. In this example the four bands cease just before the first varix, re-appear again and extend to a point short of the second varix, and come on again for a third time and cease close to the present lip.

The Manchester Museum possesses three other examples of a *Tonna* exhibiting supernumerary varices. These are small specimens of *T. maculata* (Lam.), from Bombay (Abercrombie collection). In this species the apertural thickening affects only the internal border of the aperture and not the external, hence the supernumerary varices are only visible on the outside of each shell by a well-marked line or linear groove. Internally the varices are strongly developed and form rounded ridges, resembling the typical labrum of adult individuals. In the three above-mentioned shells the pre-apertural varices vary in their distance from the present mouth.

Vredenburg, in the above-cited memoir,¹ refers to the recorded occurrence of *Dolium galea* var. *luteostoma* at Charbar on the northern shore of the Gulf of Oman, Arabian Sea.² After careful consideration he concludes that *D. luteostoma* Kuster is specifically identical with *D. variegatum* Lam., and is not a variety of the Mediterranean *D. galea*. Whether this conclusion is the right one is not easy to decide. The chief difficulty is to ascertain what is the *D. variegatum* of Lamarck. Several writers have given their interpretation of the

¹ Vredenburg, op. cit., p. 173.

² Melvill and Standen, Proc. Zool. Soc., 1901, p. 385.

species. The shell figured by Reeve (Conch. Icon., pl. v., fig. 7b) seems to agree with Lamarck's original description except as regards the spire, which is exceptionally high.¹ The latter feature, however, is variable, and shells of the same size differ somewhat in the height of the spire. Hedley has also figured what appears to be a typical *Tonna variegata* (Lam.), from Western Australia.²

In the second edition of Lamarck's work, Deshayes³ refers to a shell figured by Kiener⁴ as being the *D. variegatum*, but there are obvious differences. Lamarck's description gives: "costis convexis, confertis, aliis albis rufo-maculatis, aliis rufis." This is not the case in Kiener's shell. Philippi observed this fact in 1847 and renamed the shell *D. kieneri*,⁵ but at the same time erroneously figured as *D. variegatum* the shell known as *D. chinense* Dillw.

The Gulf of Oman shells are in the Manchester Museum where I have had the opportunity of examining them. They are two in number: one very juvenile (28 by 20 mm.); the other measures 45 by 36 mm., and is to all appearances adult. They are not *Tonna galea*, nor do they suggest the *T. variegata* as figured by Reeve. Instead of the alternating rufous and white ribs (with brown maculations on the latter) as seen in *T. variegata*, the Gulf of Oman shells have a series of alternating white and brown flames crossing all the ribs vertically. There are 15 primary ribs in each specimen, the upper half-dozen having thin interstitial riblets between them. These are crossed by very distinct axial lines of growth. The larger specimen is extremely thick-shelled, and has the inner lip spread over the body-whorl as a thick white callus. The species is probably new, but until more examples are found I hesitate to name it.

Among the recent additions to our collections is a large, dead shell of *Tonna ampullacea* (Phil.). This was presented to the Museum by Mr. A. Butt as having been collected on the Natal coast, near Durban. It is about the same size as Philippi's example⁶ and agrees fairly well with his figure, but has a slightly more produced spire. The shell is unspotted and the spaces between the distant upper ribs have finer interstitial riblets which are absent between the lower, as described and figured by Philippi. I consider this a good species and not a variety of any other. It was placed by Tryon as a synonym of *T. costata* (Menke),⁷ but is not that species. Tryon's figure is an imperfect copy of that of Philippi.

¹ Lamarck, An. s. Vert., 7, 1822, p. 261.

² Hedley, Rec. Aust. Mus., vol. xii, 1919, pl. xlv, fig. 6.

³ Deshayes, An. s. Vert. x, 1844, p. 143.

⁴ Kiener, Spec. des Coq. viv., 1835, pl. 2, fig. 3.

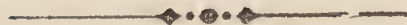
⁵ Philippi, Abbild. Beschr., iii, 1847, pl. 2 (*Dolium*).

⁶ Ibid., 1849, p. 11, pl. ii (*Dolium*).

⁷ Tryon, Man. Conch. vii, 1885, p. 263, pl. 4, f. 20.

Hedley¹ in 1919, recorded the species from Point Charles, Port Darwin, Northern Territory, Australia, but the shell figured does not resemble Philippi's species. I believe it to be a large unspotted shell of *T. maculata* (Lam.). All the ribs possess interstitial riblets and the ribs themselves have several thin spiral ridges, just as in *T. maculata*. One of the large *T. maculata* from Bombay in the Manchester Museum agrees with Hedley's figure, but is weakly spotted with brown on the spire and the upper portion of the body whorl on the ventral side.

In the course of revising the shells of the genus *Tonna* at the Manchester Museum I have had occasion to make the following alterations: Madras (Henderson coll.)²; *Tonna cumingi* (Reeve), for *Dolium chinense* Dillw. These are very small forms. *Tonna maculata* (Lam.), for *Dolium fimbriatum* Sow. These agree exactly with the Bombay specimens. *Tonna olearia* (Brug.), for *Dolium perdix* (L.); Torres Straits (Haddon Coll.)³; *Tonna olearia* (Brug.), for *Dolium maculatum* Lam.



The Rate of Growth in Planorbis.—In September, 1923, a neglected boat dock at Cookham, Berks. contained a quantity of mature *Planorbis acronicus*, Fér. In the summer of 1924 this dock was cleared out, and by the removal of the *Cladophora* in which this *Planorbis* lived, the species was almost annihilated. Two years later (Sept. 1926) the locality had largely recovered and *Planorbis acronicus* was again in evidence. Some of the shells were quite young but most were two-thirds grown, while fully mature shells were very scarce. From this it seems a legitimate inference that this *Planorbis* requires three years to attain maturity. Three other species of *Planorbis*, *Viviparus contectus*, etc., were associated with *P. acronicus* in this restricted locality, but their numbers were too few to afford any useful data of their rates of growth.—J. E. COOPER (*Read before the Society*, November 3rd, 1926).

¹ Hedley, op. cit., p. 330, pl. xlv, f. 7.

² Melvill and Standen, Journ. Conch., ix, 1898, p. 44-45.

³ Id. Journ. Linn. Soc., Zool., xxvii, 1899, p. 164.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND

548th Meeting, held at the Manchester Museum, August 28th, 1926.

Mr. C. H. Moore in the chair.

Additions to the Library announced and Thanks voted:

"British Snails. A guide to the Non-Marine Gastropoda of Great Britain and Ireland, Pliocene to Recent," by A. E. Ellis (from the author).

"Catalogue of the Conchological Collections in the Perthshire Natural History Museum," by H. Coates (from the author).

"Synonymy of the British Non-Marine Mollusca (Recent and Post-Tertiary)," by A. S. Kennard and B. B. Woodward (presented by the Trustees of the British Museum [Natural History]).

Also several pamphlets from C. Oldham, J. W. Jackson, H. Schlesch, A. S. Kennard, and B. B. Woodward.

Donations to Cabinet.

Several species of *Limicolaria* from Shillem, Zola, N.E. Nigeria (coll. Rev. Erland Kjør (from H. Schlesch). *Valvata cristata* and *V. macrostoma* (new record) from Wilton Bridge, Norfolk (from F. Taylor).

New Member Elected.

William J. Clench.

Candidates Proposed for Membership.

Mrs. Alice Anderson, Hortensia, Lennox Road N., Southsea (introduced by J. W. Jackson and C. H. Moore).

H. J. Boekelman, De Land, Florida, Box 331 (introduced by W. H. Weeks and J. W. Jackson).

W. Stanton Brown, 59, Southfield Square, Bradford (introduced by Fred Rhodes and Alfred Hartley).

Members Resigned.

Alfred A. Moore.

Robert Charles Moore.

Members Deceased.

Edward J. Bles.

George A. Martin.

Papers Read.

"*Tonna* (= *Dolium*) *fasciata* (Brug.), with two pre-apertural varices; and Notes on other forms," by J. Wilfrid Jackson, M.Sc.

"The History of *Helix hortensis* and *Helicella caperata* at Aberdeen," by A. E. Boycott, M.D., F.R.S.

"Food of *Limax flavus*," by C. H. Moore.

Exhibits.

By Mr. E. R. Brown:—Large tray of the smaller *Oliva* including *O. polita*, *O. duclosi* and var., *O. rufula*, *O. rufopicta*, *O. smithi*, and *O. hieroglyphica*.

By Mr. F. Taylor:—An extremely beautiful series, including very young stages, of *Acicula lineata*, *Pupilla anglica*, and *Carychium minimum*, from Forge Valley, Scarborough; *Valvata macrostoma*, *V. cristata* and *Bithynia leachii*, from Wilton Bridge, Norfolk, also the first and second from the Suffolk side.

By Mr. J. Wilfrid Jackson:—Shells to illustrate his paper, and the specimens of *Limicolaria* from N.E. Nigeria, donated to the Cabinet by Hans Schlesch.

The Special Exhibit was *Tonna* (= *Dolium*).

Jubilee Meeting, held at the Leeds City Museum, October 16th, 1926.

The President, Mr. J. W. Taylor, in the chair.

Amongst those present were the following :—Messrs. Fred Rhodes, J. A. Hargreaves, J. Digby Firth, Greevz Fysher, J. H. Lumb, W. Harrison Hutton, C. H. Moore (and Mrs. Moore), B. R. Lucas, A. K. Lawson, G. C. Spence, J. Davy Dean, C. Oldham, F. Taylor, J. W. Jackson, H. Crowther, Drs. A. E. Boycott, and A. J. E. Cave, Mrs. J. W. Taylor, Mrs. Crowther, Messrs. H. J. Armstrong, and J. R. Dibb.

The following Delegates were also present :—Mr. R. J. Welch (Belfast Naturalists' Field Club), Mr. H. Sowden (Yorkshire and District Field Naturalists' Society), Rev. C. E. Y. Kendall (Liverpool Biological Society), Mr. C. N. Bromehead (Geological Survey), Mr. F. W. Fierke (Hull Scientific and Naturalists' Club), Mr. W. Gygell (Scarborough Philosophical and Archæological Society), Dr. C. M. Yonge (Marine Biological Society of U.K.), Dr. A. J. Grove (Birmingham Natural History and Philosophical Society), Prof. W. Garstang (Linnean Society of London), Mr. T. W. Saunders (Doncaster Scientific Society), Dr. W. E. Collinge (Yorkshire Philosophical Society), Mr. R. G. S. Hudson (Geologists' Association of London), Mr. E. E. Gregory and Mr. W. D. Hincks (Leeds Naturalists' Field Club and Scientific Association), Mr. H. C. Versey (Yorkshire Geological Society), Mr. J. R. B. Masefield (N. Staffs. Field Club), Mr. E. Hawkesworth (Leeds Philosophical Society and Yorkshire Naturalists' Union).

Letters of congratulation were received from many other Societies who were unable to send representatives to the meeting.

The President, in opening the proceedings, welcomed the representatives of the several Learned Societies who were present, and, on behalf of the Council and members, thanked them for their cordial response to the Society's invitation to attend the Jubilee Meeting. A cordial vote of thanks was also accorded to Societies who had sent congratulatory letters.

Several of the delegates spoke in warm terms of the work of the Conchological Society during the fifty years of its existence.

Appointment of Scrutineers.

The Rev. C. E. Y. Kendall and Mr. F. Rhodes were appointed Scrutineers.

Appointment of Auditors.

Messrs. C. H. Moore and G. Owen were re-appointed Auditors.

New Members Elected.

Mrs. Alice Anderson, H. J. Boekelman, W. Stanton Brown.

Resignations.

J. H. D. Saunders, C. Leslie Odam.

History of the Society.

After the presentation of the various Annual Reports the Hon. Secretary, Mr. J. Wilfrid Jackson, M.Sc., F.G.S., read a short History of the Society in which he dealt briefly with its genesis and progress.

Presidential Address.

The President delivered an address on "Mutations in the Mollusca," illustrated with lantern slides.

A cordial vote of thanks was passed to the retiring President for his interesting address.

Votes of thanks were also accorded to the Authorities of the Manchester Museum for the use of rooms and light for the monthly meetings of the Society, and to the Authorities of the Leeds City Museum for the use of rooms for the Jubilee Meeting.

Election of Officers and Council.

The Scrutineers reported that the Officers and Council for 1926-27, as nominated, had been unanimously elected.

Exhibits.

By the Rev. C. E. Y. Kendall:—*Helix pomatia*, including a specimen with nacreous lining, from Coulsdon, Surrey; *Clausilia bidentata*, elongate example, from Silverdale, Lancs.

By Mr. H. Sowden:—*H. arbustorum*, varieties from the York district; also darts of *Helices*.

By Prof. A. E. Boycott:—*Planorbis nautilus* with disjointed whorls, from Aldenham, Herts.; also magnifying spectacles (Watson & Sons) suitable for examining small shells.

By Prof. Boycott and Capt. C. Diver:—*Limnæa pereger*, albinos and pigmented brothers. The body is quite free from black pigment; the eyes are visible but not black and microscopically contain no melanism. It breeds out as a simple Mendelian recessive.

By the Rev. L. W. Grensted:—A curious *Unio* from the River Thames near Oxford (probably *U. tumidus* var. *ovalis*).

By Dr. W. E. Collinge:—*H. aspersa* from Roman excavations at York, found 12 feet below the surface.

By Prof. W. Garstang:—A series of drawings illustrating his forthcoming memoir on the development and metamorphosis of *Echinospira*, the pelagic larva of *Lamellaria*, which is unique in possessing two shells of different shape, one inside the other.

By Mr. R. J. Welch:—Holocene shells from Irish sandhill deposits, shell-marls and crannoges.

By Mr. G. C. Spence:—*Achatina fulica* m. *sinistrorsa*, from Mauritius (one of the two recorded examples of this form); *Limicolaria* spp. from Nigeria.

By Mr. A. K. Lawson—*Helix aspersa* var. *rugulosa*, Miramare (coll. Bülow); var. *acuminata*, Green; *H. pomatia*, scalariform and reversed examples, from France, etc. (from the Edward Collier collection now in Altrincham Museum).

By Leeds City Museum:—Stubbs Collection of British Land and Freshwater Mollusca.

By Mr. J. C. Dacie:—A large and interesting series of land shells collected at Southwold, Suffolk, in August, including *Helix aspersa* var *minor*, *minor conoidea*, and *conoidea*, all remarkable for their extreme thinness; *H. nemoralis*, many variations in colour of shell and lip; *H. virgata*, *H. caperata*, and *H. cantiana*.

By Mr. W. Gyngell, for the Scarborough Philosophical and Archæological Society ex. coll. William Bean, made about one hundred years ago, recently acquired by and now in the possession of the above Society: *Purpura lapillus* L. sinistral monstrosity, the specimen referred to by Jeffreys in "British Conchology," vol. 4, p. 278 and its romantic story and sequel retold by Marshall in the Journal of Conchology, vol. 13, p. 196; *Littorina littorea*, L. sinistral monstrosity from Exmouth, ex. coll. Leckenby, referred to by Jeffreys; *Neptunea antiqua* L. sinistral monstrosity; the type specimens of *Beringius turtoni* Bean, and *Chiton hanleyi*, Bean; *Helix aspersa*, Müll., m. *sinistrorsum* and m. *scalariforme*. Also from his own collection sinistral examples of *Helix aspersa*, Müll., *H. virgata* da C., *H. caperata* Mont. taken at or near Scarborough, *H. striolata* Pfr. taken near Peterborough, all previously recorded; a scalariform and two-banded form of *H. arbustorum* L., monstrosities of *Limnæa pereger* Müll., a twisted specimen of

Planorbis parvus Say, giant specimens of *Planorbis corneus*, L. from Boynton Fish Ponds, Yorks., but not now obtainable; *Helix arbustorum* v. *minor* from Norton, *H. aspersa* Müll. v. *ponderosa*, weight 96 grains, from Hutton Bushel; *H. nemoralis* v. *minor* Redcar Sandhills, *Limnæa pereger* Müll. var. *stagnaliformis*, Taylor from ditch, First Lane, Hessle, Hull, and specimens of a conoid form of *Helicella virgata* da C. and *H. itala* L. from Speeton red chalk.

ANNUAL REPORT.

THIS is the Fiftieth Annual Report of the Society. Since the last Annual Meeting the Society has lost ten members by death, ten by resignation, and three have been struck off the roll of members in accordance with Rule IV, making a total loss of twenty-three. Ten new members have been elected during the year, and the membership to-day is 259, as against 272 in October, 1925.

The losses sustained by death are :—Bernard Arnold, Jacques Savès, Frank Morey, R. Bullen Newton, W. Evans Hoyle, W. H. Heathcote, J. W. Boulton, K. I. Anderson, G. A. Martin, and Edward J. Bles. Short Obituary Notices of two of these have been published, viz. of Dr. Hoyle in *Journal of Conchology*, vol. 18, p. 33; and of R. Bullen Newton in the *Journal of Conchology*, vol. 18, p. 11.

Eight monthly meetings have been held at the Manchester Museum (by kind permission of the Authorities). Seventeen notes and papers have been read and several of these have appeared in the *Journal*. The Special Exhibits have been *Partula*, Jamaican Land Shells, *Achatinella*, Madeiran Land Shells, *Helicarion*, Lord Howe Is. Shells, and *Tonna* (= *Dolium*).

Since the last Annual Meeting three numbers of the *Journal* have been issued: vol. 17, No. 9, October, 1925 (completing the volume); vol. 18, No. 1, March, 1926; vol. 18, No. 2, September, 1926, comprising 100 pages of text (including Index, etc., to vol. 17), one plate, and five text-figures. In addition the members of the Society have been presented by Mr. McClelland with a copy of his General Index to the four British serials devoted entirely to Conchology and Malacology. The Council takes this opportunity of congratulating Mr. McClelland upon the completion and publication of this work, and of thanking him for his generosity in presenting copies to the members.

The Library has received additions from Drs. L. Soos, J. H. Orton, W. H. Dall, H. A. Pilsbry, Paul Bartsch, W. Polinski, Messrs. H. Schlesch, C. Oldham, W. B. Marshall, J. W. Jackson, C. M. Steenberg, George Sich, A. S. Kennard, B. B. Woodward and Miss T. van Benthem Jutting. Publications have also been received from the Trustees of the British Museum (Natural History), the Committee of the Manchester Museum, and the Council for Scientific and Industrial Research, Melbourne.

Donations to the Cabinet have been received from Messrs. Hans Schlesch and Fred Taylor.

RECORDER'S REPORT (Non-Marine Mollusca).

SINCE the last report (vol. xviii, p. 28) the following new records, 26 in number, have been authenticated for the Census :—

Scilly Is. (1a):—*Pisidium obtusale* (J. R. Tomlin), *P. casertanum* (G. C. Robson).

Cornwall E. (2):—*Pisidium personatum* (C. E. H. Burton).

Isle of Wight (10):—*Testacella scutulum* (G. C. C. Damant), *Pisidium personatum* (C. Oldham).

Hants N. (12):—*Planorbis carinatus*, *Pisidium amnicum*, *P. casertanum*, *P. henslowanum*, *P. milium* (C. Oldham).

Kent E. (15):—*Pisidium hibernicum* (per B. B. Woodward).

Kent W. (16):—*Physa heterostropha* (Ravensbourne at Shortlands: L. B. Langmead).

Herts (20):—*Acanthinula lamellata* (Knebworth: Jane D. Robertson).

Oxford (23):—*Planorbis stroemi*, *Sphaerium pallidum* (L. W. Grensted).

Norfolk W. (28):—*Valvata macrostoma* (F. Taylor).

Huntingdon (31):—*Pisidium casertanum*, *P. personatum* (C. Oldham).

Gloucester E. (33):—*Zonitoides excavatus* (E. P. Blackburn).

Hereford (36):—*Planorbis carinatus* (J. W. Vaughan).

Worcester (37):—A dead *Margaritana margaritifera* at Knightsford Bridge (L. W. Grensted) is probably attributable to Salop (see vol. xvii, p. 278).

Yorks. N.W. (65):—*Pisidium henslowanum* (G. Fysher).

Durham (66):—The record for *Planorbis corneus* in Northumberland S. (vol. xvii, p. 223) should be transferred to Durham.

Northumberland S. (67):—Specimens of *Circinaria vancouverensis* introduced from western North America have been found alive at Haltwistle (E. P. Blackburn) and it may possibly persist and spread.

Selkirk (79):—*Hyalinia radiatula*, *Hygromia fusca* (J. Roseburgh).

Elgin (95):—*Limax tenellus*, *Pisidium casertanum* (A. E. Boycott).

Easternness (96):—*Pisidium lilljeborgi* (A. E. Boycott).

RECORDER'S REPORT (Marine Mollusca)

I regret to report an almost complete apathy. Only two members of the Society have sent specimens for record: consequently the records still consist only of those I have prepared from my own collections and others I have access to. Under these circumstances I recommend that the request for co-operation in recording marine species should be made the subject of an editorial note only instead of occupying a page as in the last number but one of the Journal. I hope to stir interest by asking for records in a more widely collected group than the Chitons. But if another year passes without any interest being taken in the matter, I see no point in continuing to use up space in the Society's Journal: if, however, as I hope, interest increases, I will gladly undertake the duties of Recorder as long as the Council approves.—R. WINCKWORTH.

ANNUAL REPORT OF THE YORKSHIRE BRANCH.

THE first meeting of the Session was opened by the President, when he compared the Marine with the Land and Freshwater Mollusca. This was followed by an interesting paper on "Freshwater Pearls" by Mr. W. Harrison Hutton, F.R.M.S.

At the February meeting Mr. R. G. S. Hudson, M.Sc., F.G.S., lectured on "Directive Evolution illustrated from the Fossil Mollusca" and was greatly appreciated.

In March a highly stimulating lecture entitled "Collecting Reminiscences" was delivered by Mr. F. Rhodes, F.E.S., admirably illustrated by a collection of the common Yorkshire Shells.

Mr. J. C. North, F.R.P.S.L. visited us in October and displayed a magnificent series of the Land Shells of Malta, including some very rare species. At all these meetings members have shown and described most interesting general exhibits.

One of the most gratifying experiences of this year's activity has been the splendid attendance at all our Field Meetings as well as at the indoor meetings. This is probably due to the increased membership of the Branch, which now stands at 47.

Mr. Greevz Fysher has succeeded Mr. E. E. Gregory as President of the Branch. Mr. John R. Dibb was elected Hon. Secretary and succeeded Mr. J. Digby Firth, who has served so well as Acting Hon. Secretary.

Two meetings are still to be held to complete the eleven arranged for the session. 1926 has proved one of the most successful years known in the annals of the Yorkshire Branch of the Conchological Society.

JOHN R. DIBB, *Hon. Sec.*

ANNUAL REPORT OF THE LONDON BRANCH.

THIS BRANCH is in a flourishing condition. It has an increased membership and the keen interest shown by the members has made the Monthly Meetings successful in every way.

Owing to the General Strike and then the Coal Strike, causing a curtailment of railway-travelling, Field Outings were abandoned for this year.

J. DACIE, *Hon. Sec.*

550th Meeting, held at the Manchester Museum, November 3rd, 1926.

Mr. G. C. Spence in the chair.

Papers Read.

"The rate of growth in *Planorbis*," by J. C. Cooper.

"*Paludestrina jenkinsi* on Skomer Is.," by C. Oldham.

"Notes on a colony of *Helicella virgata* on the Red Chalk of Speeton, Yorks.," by W. Gyngell.

"Two fossil species of *Leptashatina* from the Island of Kanai," by Prof. T. D. A. Cockerell.

"Mollusca of Southwold, Suffolk," by J. C. Dacie.

"Disappearance of *Littorina rudis* v. *tenebrosa* at Walton-an-Naze and at Walberswick, by J. C. Dacie.

Exhibits.

By Mrs. Gill :—Series of *Oliva angulata* from Nicoya.

By Mr. J. C. Dacie :—Specimens to illustrate his notes.

By Mr. J. W. Jackson :—*Voluta magellanica* and other species from the Falkland Islands (coll. Mrs. Blake, and now in Manchester Museum); series of shells from Mazatlan, mounted on glass tablets (recently presented to Manchester Museum by Mr. E. R. Brown).

***Helicigona arbustorum* var. *suprafasciata* and var. *trifasciata* in Staffordshire.**—Mr. Hill, of Leek, has found at Consall these two rare forms of *H. arbustorum*, that would appear to indicate that *Helicigona* may have passed through the Pentatæniate band arrangement. The var. *suprafasciata* was thus named by Prof. Cockerell some years ago, this specimen has but one band, which occupies the position of No. 2 in the Pentatæniate formula. The var. *trifasciata* has the usual peripheral band while the fourth and fifth bands are represented by slightly darker pigmentation, but are still more definitely defined by groups of deeply incised and closely arranged spiral groovings. Band 4 shows *nine* of these distinct channellings, while the basal or lowermost band shows only seven.—JOHN W. TAYLOR (*Read before the Society, Dec. 1st, 1926*).

The "MUTATIONS" of our NATIVE LAND and FRESHWATER MOLLUSCA.

BY JOHN W. TAYLOR, M.Sc.

(Presidential Address delivered at the Jubilee Meeting, October 16th, 1926).

THE topic, which I have selected for this address, is one of great interest and importance, not only for the light it sheds upon the past history of the various groups, but, also, as giving us clues to the direction in which progress or deterioration is taking place, and in what way the habits of life are becoming gradually but radically changed.

The term "Mutation" is used in its original sense for the very slow and gradual or "Historical" changes in a definite direction as proposed by Dr. Waagen and others, and it is singularly appropriate to the present subject, as many of the changes alluded to here take untold centuries to complete, and are ever in progress.

The Mollusca are an excessively ancient group, and we have little or no evidence as to the precise period when the Phylum originated, as many of the chief groups were existent and well-differentiated before the deposition of the earliest known fossiliferous strata, so that it is

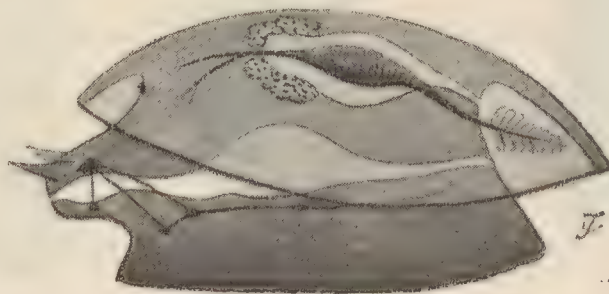


FIG. 1—Hypothetical Primitive Mollusk, showing the alimentary and nervous systems, also the shell, heart and respiratory organs (after Pelseneer).

only from the study of their Embryology, Anatomy, and Palæontological history that we can ascertain, to some extent, the relative periods of the Evolution of the Mollusk and its shell, from its first inception through all its evolutionary progressive or retrogressive changes.

In studying Evolution, we must not, as we so frequently do, give all our attention and thought to the Progressive sections, and ignore or only touch upon, the less active individuals which constitute the less successful, but far more numerous groups, that by compulsion or choice become modified to conform to other foods, or other and different modes of life, such enforced changes usually tending to an undue degree of specialization, by a more rigid adjustment of structure to the peculiarities of the life conditions to which they become restricted, a trait which may lead to the adoption of a concealed or burrowing existence within rocks, timber, earth or other

protective substances or even to their becoming parasitic within or upon the bodies of other animals, actions which in the end are all fatal to advancement.

All our species are thus not equally plastic and adaptable: some groups as *Nautilus*, *Chiton*, *Natica*, etc. have a long line of ancestors reaching back to the most remote geological periods, yet have undergone little apparent progress or change.

Creation as contrasted with Evolution, is regarded as the instant formation of the creatures or objects we see around us, at the will of the Creator; whereas Evolution implies the gradual processes, by which our varied animal and plant life has been built up from the very simplest forms, by slow and almost imperceptible changes, and as I am inclined to believe this life in its very simplest form—irritability—is constantly being infused into or developed within inorganic albuminoid matter, but the line between the Reactions or Responses of animate and inorganic matter is difficult to define.

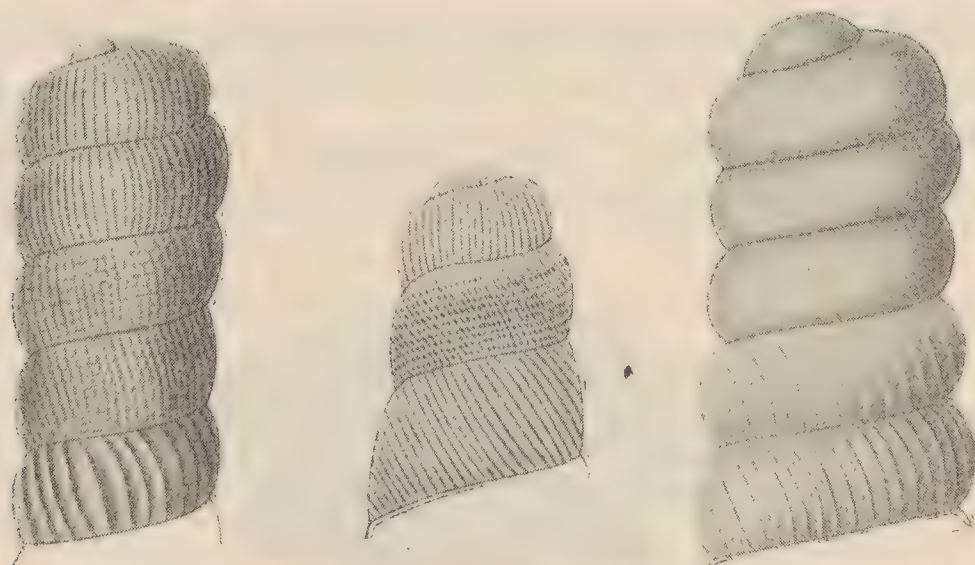


FIG. 2

FIG. 3

FIG. 4

Figs. 2-4. Protoconchs or Vestigial apices of various exotic species, representative of different genera of terrestrial gastropods, and illustrating the noticeable successive changes of sculpture, etc. in Primary, Secondary and Tertiary shells (after Simroth).

Fig. 2—*Coelocentrum eisenianum*, Pilsbry, Mexico; Fig. 3—*Berendtia taylori*, Pfr., California; Fig. 4—*Cylindrella polygyra*, Pfr., Mexico.

There is little doubt in the minds of those who have studied the subject that the Mollusks as seen to-day do not possess permanent shells, or that they are the first, or only ones, they have had; but on the contrary, when viewed historically, the shell is seen to be quite unstable, as we find reliable evidences that Mollusks are always undergoing slow but persistent changes in form, in habits and in organization, and that we may correctly speak of Primary, Secondary, and even Tertiary Shells, which have successively “waxed and waned” in passing through these evolutionary changes, and in many cases have left convincing evidences of their previous history, but in some species the changes in the shell are so excessively slow, that little external difference can be distinguished between some of our most ancient fossils, and their living representatives of the present day.

The various species of Mollusks during the illimitable past have undergone many Morphological, Habitudinal and Physiological changes, before acquiring their present-day aspect and mode of life, but with our limited and imperfect knowledge we can seldom trace the cause or causes of the varied evolutionary processes, and unless we study a group comparatively, as so brilliantly exemplified by Prof. Tattersall with *Littorina*, we do not appreciate the striking continuity of the changes in process of slow accomplishment.

Most of our native species are possessed of shells which are now, and have been for untold centuries undergoing the process of Degeneration or Deterioration, and will eventually become vestigial by attenuation of shell-substance and reduction in size or number of whorls, while in other cases the absorption of the shell is preceded by a considerable extension of the growth of the mantle-lobes which gradually overlap and envelop the shell as is so strikingly exemplified in the decadent shells of *Vitrina*, *Amphipeplea* and *Physa* and in a still more advanced stage by the Limaces and Arions.

The Progressive and Retrogressive Evolutionary growth and structure of the Molluscan shell has been studied in its visible aspects by Dr. Swinnerton, who states that the Progressive and dominant groups of Mollusks are characterized by the increases of their shells being orderly, regular and consistent, while Retrogressive or Senescent groups are indicated by the growth-changes being irregular and uncertain, the rate of growth may also diminish and the whorls remain uniform in calibre or even decrease slightly, the shell then tending to assume the cylindrical form as in *Pupa*, *Clausilia*, etc.

Usually, however, Senescence is indicated by a rapid increase in calibre, so that the outer whorls may become greatly expanded, and more or less completely envelop the earlier whorls, while the shell substance may be reduced to a mere film, as seen in *Amphipeplea*, *Physa*, etc. Senescence of the shell is now manifested in many families, and is suggested by a total absence of all ornamentation or by the excessive development of decorative adjuncts.

Sometimes, in quite unrelated groups, there is a combination of expansion and Retrogressive unrolling as in *Ancylus fluviatilis*, in which species the Protoconch is coiled, while the rest of the shell is strictly conical and almost unrolled.

Degeneration in size is another mode in which Retrogression of the shell may take place, and, from some points of view, this form of deterioration is a direct result of the struggle for existence, as it diminishes the demands of the organism for nourishment by reducing its requirements, while its reduced size gives greater facilities of concealment from enemies.

Thus many groups in the European region have some of their constituent species reduced to a small and quite insignificant size, but in other and evolutionarily weaker regions, where the struggle for existence is less severe, show a number of closely allied forms which grow to quite a good size.

Naturally all organisms differ in the precise manner in which they respond to changes in the forces of the environment, some alter their mode of life, others may become structurally adapted to their new surroundings or conform in other ways to circumstances.

“Over-Specialization” or Structural Modification of the Animal and its organs to adapt them more rigidly to extreme or peculiar life-conditions is not conducive to advancement, and the less extreme forms are always the sources from which the more Progressive groups arise, for as Prof. Elliott Smith has remarked: “The Retention of certain Primitive characters, though often looked upon as signs of congenital weakness, is, in reality, probably an evidence that the plasticity associated with primitivity, has enabled the organism to dispense with the protective specialization, which often leads to a rigid limitation of its activities and to decadence.”

The Progress of Evolution may, in my opinion, be very aptly compared with a “Relay-race,” each group or species bearing the “Torch of Progress” for a certain period only, until the Progressive impulse is exhausted or the group or species becomes “over-specialized” in its habits or structure; when another and probably a less specialized section takes up the “Torch” and bears it along the Progressive Evolutionary path.

Heredity is but the direct and indirect effects of the great and unresting, active and passive forces of the environment, animate and inanimate, pre-natal and post-natal, with the consequent modifications of the habits, structure and aspect of the animal, induced by their sustained action, and the longer and more intimate the peculiarities of the environment persist the greater the impression on the organism, and the more certain that the modification may become heritable, thus Variation and Varieties are virtually the responses or reactions of the organism to the collective forces of the environment.

That the Environment does actually induce Variation, by impressing characteristic features upon such organisms as live within its influence, has been clearly demonstrated, but such influences when not thoroughly fixed in the organism are not permanent, but may cease when the Mollusk is removed from its native locality and submitted to other influences.

The striking and abrupt changes of external superficial shell-characters in Oysters have been verified many times and demonstrate that each local area has its peculiarities which are unfailingly imprinted on the growing shell, thus the Mediterranean Oyster (*Ostrea edulis*) is distinguished by its prominent divergent ribs radiating from the umbones, while those inhabiting Whitstable and other places are noticeably different.

The experiment has been tried of transplanting a number of two-years old Oysters from the Mediterranean to Whitstable, and at the same time taking a number of two-years old Whitstable "Natives" and transferring them to the Mediterranean, both colonies being then left undisturbed for two years. When examined at the end of that period it was found that the Mediterranean and Whitstable shells had both relinquished their native modes of growth, and the new growth in each case was strictly in accord with the characteristics of their new habitat, and this was clearly separated from the part of the shell formed in their place of origin.

In fact it has been demonstrated many times that the characters appropriate to certain localities are immediately shown at the growth-season in the shell. Thus Oysters one year old were brought from Brittany and transplanted to Hayling Island. After two years there the Oysters had acquired the flavour, texture and colour characteristic of Hayling and were quite distinguishable from Brittany shells, and when transferred to Whitstable they acquired the characteristics of the Oysters there, yet retained in the earlier growths the distinguishing features acquired successively in Brittany and at Hayling.

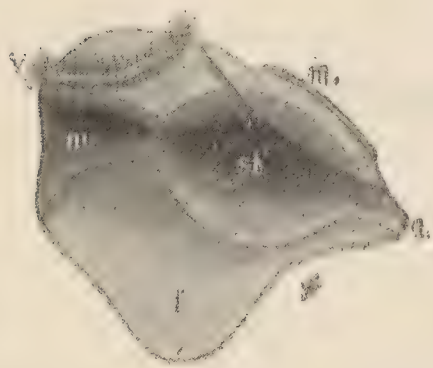


FIG. 5



FIG. 6

Fig. 5--Trochosphere of *Vivipara* (after Butschli).

a. anus; *f.* foot; *m.* mouth; *st.* stomach; *m.* mantle and shell.

Fig. 6--Trochosphere of *Limnaea stagnalis*, illustrating the conchal or shell-gland (after Lankester).

c.gl. cerebral ganglion; *d.gl.* developing digestive gland; *f.* foot; *m.* mouth; *pn.* pronephros or larval kidney.

All MOLLUSKS undergo a series of orderly embryological changes, which represent or recapitulate in a simplified and very abbreviated way the more important and characteristic stages of the early Life-History of the group.

In this Developmental process, the first really important stage is the formation of the Trochosphere which in its early typical state is a free-swimming, bilaterally symmetrical, larval form, with mouth in front, a direct alimentary canal, with the anal, and other orifices in the rear, progressing by ciliary action, and bearing a dorsal Shell-gland, upon whose glandular area, a viscid chitinous substance known as Conchyolin is secreted, which hardens in contact with water, and is regarded as the earliest known rudiment of a nascent, primeval shell, the Protoconch of authors. This Protoconch, or relic of a former shell, often forms the apex of spiral shells and is usually quite different in aspect and structure to the present day shell.



FIG. 7—Hypothetical Genealogical Tree of the Evolution and Development of Mollusca, showing the relative periods of the appearance of the various groups.

There may even be recognizable relics of two, three or even more of these formerly functional shells, which have successively passed through the evolutionary phases of youth, adolescence and maturity, followed eventually by the degeneration or dwindling away of the successive shells, except for the apical remnants, which are happily conserved to furnish reliable evidence of the reality of their former existence.

In the *Pelecypoda* the chitinous secretion fills the median invagination of the "Shell-gland," which corresponds with the hinge-line of the shell of the adult Bivalve and constitutes the "Ligament." The secretion also extends on both sides of the median line, producing the two-valved condition and capping the umbones of the Bivalves, and is the Prodissoconch of authors.

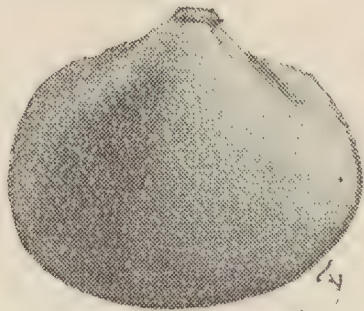


FIG. 8—The Prodissoconch or Primary Shell of *Sphaerium lacustre* (Müll.) showing the caliculation or capping of the modern shell, by the ancestral vestige.

This Trochophoral stage of Development is very important and significant as indicating the precise period when the creeping *Chitons* or *Amphineures* detached themselves from the common molluscan stem and diverged from the developing, sedentary Bivalves, before the First Torsion of the Visceral-dome was initiated, and have therefore retained the primitive bilateral symmetry of the various paired organs of the body, which the rest of the phylum has more or less lost.

The *Amphineura*, or as we might term them Proto-Gastropoda, are very lowly creatures, displaying also a relationship or affinity with the *Annulosa*, or Worms, in the distinct segmentation of their shell, as well as by the blood-circulatory system, which is reminiscent of that of a segmented organism in possessing a series of lateral gills on each side of the body, and a median longitudinal Ventricle.

The *Pelecypods*, or Bivalves following the separation of the *Amphineura*, or Proto-Gastropods, also now diverge from the common molluscan stem, and the first stage of the Torsion of the body is initiated by the gradual elongation of the digestive tract, due to the growth and the increasing importance of the shell, and of the creeping foot, whose enlargement interferes with the functional efficiency of the Respiratory and other vital organs, and compelling a flexure or folding upon itself of the intestinal tube as part of the equatorial or ventral semi-rotation of the whole pallial-complex—an aggregation of the essential organs and their ducts—and eventually resulting in their gradual transposition from their original station in the rear of the body to an antero-ventral position.

The *Pelecypods* are really a sluggish and degenerating group, and one of the earliest to become separated and divergent from the generalized or Family-stem, before the bodily torsion alluded to had

well begun, as they have almost completely retained their bilateral symmetry, with the alimentary canal terminating in the rear. They also exhibit a marked tendency to indolence and inactivity, burying their shells in the bed of the river, stream or pond, and evolving by modifications of the mantle-margins, more or less elongate, posteriorly placed siphonal organs for respiration, feeding and defecation.

In the ocean they become even more modified and pierce the rocks or timber for shelter and protection ; these protected modes of life lead to determining modifications of the shell, the most specialized forms being the elongate, cylindrical shape assumed by the *Solenidæ*. All the stages from the somewhat oval ambulatory form to the deeply burrowing cylindrical *Solen* are exemplified in living species.

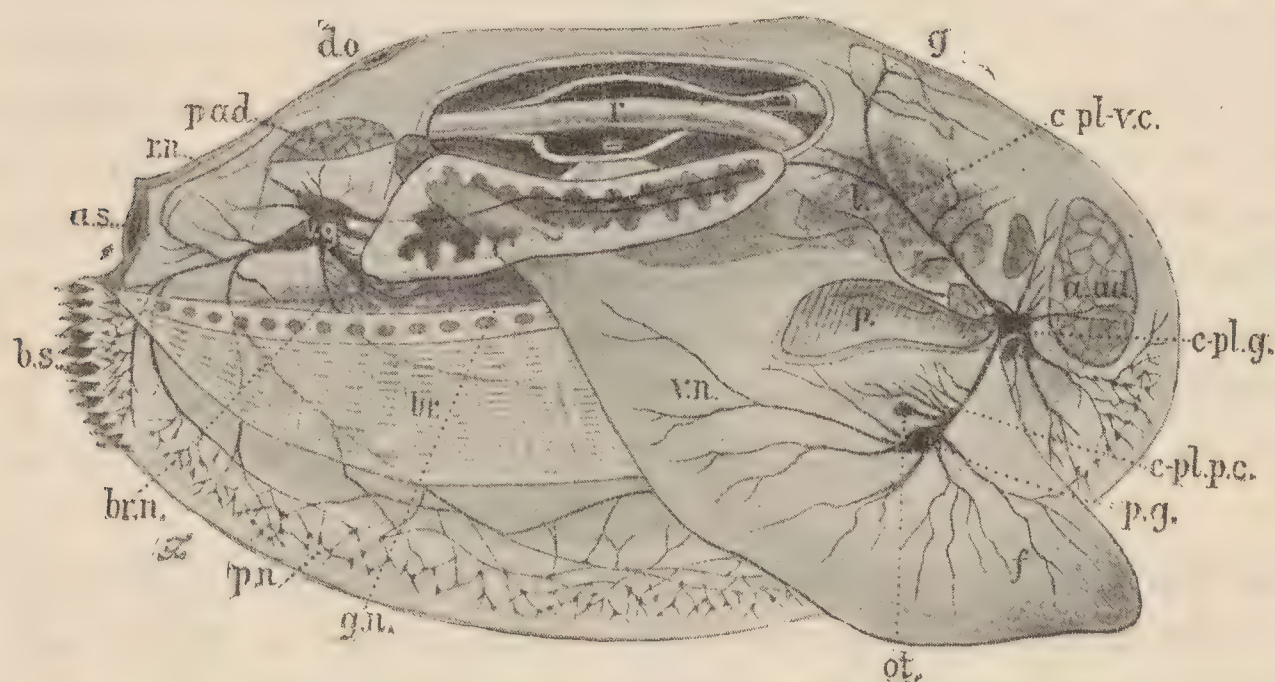


FIG. 9.—*Anodonta cygnea*, showing the disposition of the ganglia and the general arrangement and distribution of the dependent nerves, as seen from the right side after removal of the right mantle lobe, and the right ctenidia; the pericardium, the ventricle, and the right nephridium opened up (modified after Duvernoy, Howes, and others).

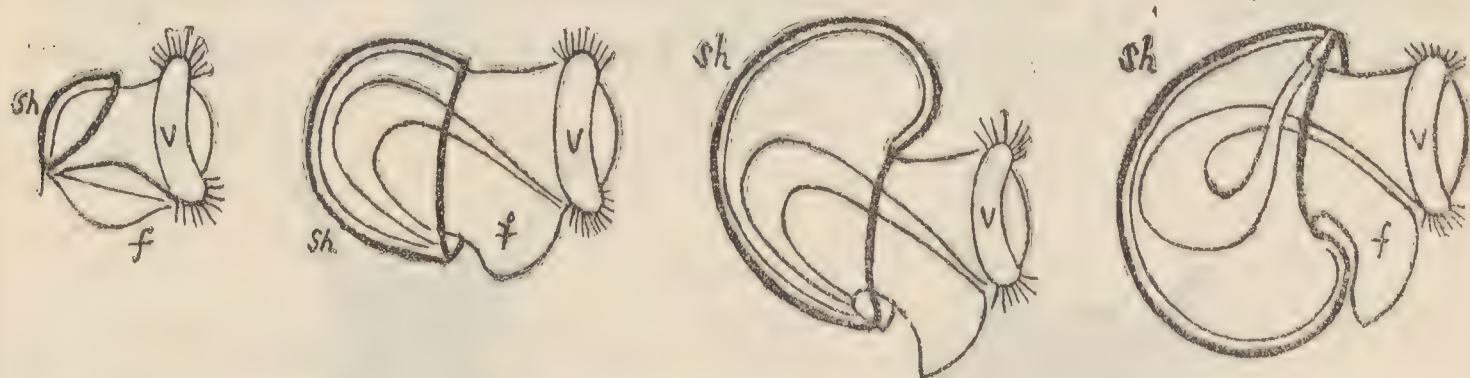
a.ad. anterior adductor; *a.s.* anal siphon; *br.* branchia; *br.n.* branchial nerve; *b.s.* branchial siphon; *c-pl.g.* cerebro-pleural ganglia; *c-pl.p.c.* cerebro-pleuro-pedal connective; *c-pl.v.c.* cerebro-pleuro-visceral commissure; *d.o.* dorsal orifice; *f.* foot, with ramifying pedal nerves; *g.* gastric nerve; *g.n.* genital nerve; *l.* liver or digestive gland; *ot.* otocyst; *p.* palps; *p.ad.* posterior adductor; *p.g.* pedal ganglia; *p.n.* pallial nervous plexus, shewing numerous small ganglionic enlargements and the general anastomoses of the anterior and posterior pallial nerves; *r.* rectum; *r.n.* nerve of rectum; *v.g.* visceral or parieto-splanchnic ganglia; *v.n.* visceral nerves from pedal centre.

The inferiority of the *Pelecypods* in the scale of nature is indicated by the small and widely separated ganglia or nerve-centres which are scattered through the body and not aggregated together as in the higher gastropods, and hence were classified as Heterogangliata in contrast to the Gastropoda which are termed Homogangliata.

The **Scaphopoda** are the next group to separate from the common stem and show a large degree of the approximation of the two ends of the alimentary tract, a feature appropriate to their organization and habits of life. They are a simply organized degenerate group, possessing a long, slender, and slightly curved tubular shell, open at both ends. In structure the animal has a simple heart, without

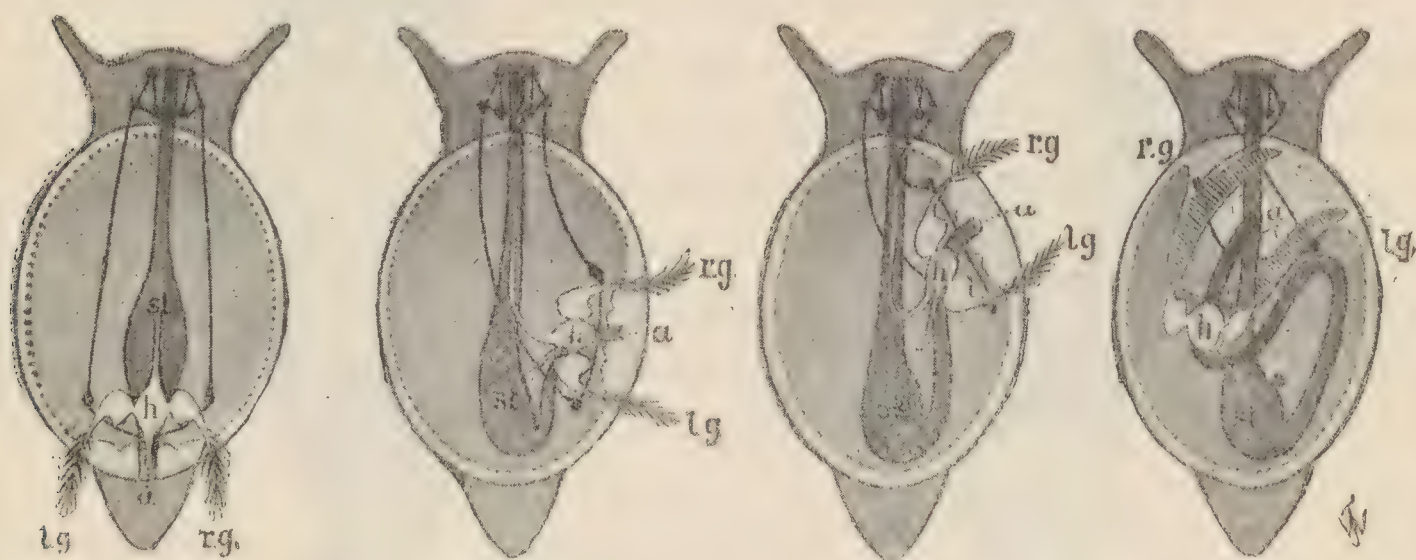
auricles and a lacunar blood circulatory system, with no special respiratory organs, and a very slightly developed head ; they burrow in the mud by the aid of their muscular cylindrical and pointed foot. The group is said to begin life as Bivalves, but later the shell is composed of a single piece, probably another example of the evolution of a Primary and Secondary shell.

The **Cephalopoda** represented by the vigorously swimming and primitive Tetrabranchiate Cephalopods were the next group to diverge from the common Molluscan stem, after their acquirement of the Discoid or Planorboid mode of coiling of the shell, and it is to be remarked that the *Nautilus* and other cephalopodous groups still preserve this primitive Exogastric mode of coiling and carrying of the shell, which is so characteristic of this Evolutionary stage.



Figs. 10—13. Diagrammatic vertical aspect of the stages of the Torsion and chief flexure of the intestinal tract in the Gastropoda (after Swinnerton).

f foot, *sh* shell, *v* velum.



Figs. 14—17.—Diagrammatic aspect from above of the stages of the Torsion and chief flexure of the intestinal tract in the Gastropoda (after Butschli).

a anus, *h* heart, *lg*. left gill, *rg*. right gill, *st*. stomach.

The primitive character of the Tetrabranchiate Cephalopods is also emphasized by the Annulose or Worm-like features of their circulatory system, which consists of two pairs of lateral branchiæ and four auricles to the single longitudinal ventricle, a strong evidence of their relationship to segmented organisms.

This rotatory movement of the vital organs is not restricted to the Mollusca, but is a movement shared in by the *Crustacea*, the *Echinoderms*, the *Bryozoa* and other organisms.

In the **Gastropoda** the next important feature of this veligerous stage of development of the Molluscan phylum is the establishment of the

Helical mode of coiling, which superseded the simpler Planorboid or discal coiling of the Trochophoral stage, and is due to what may be termed a Vertical torsion from right to left, of the "Pallial complex" transferring the organs from an antero-ventral position to an antero-dorsal one.

All these changes were complicated one with another, but have been separated here and arranged in the order of their appearance and were completed before the close of Palæozoic time, but the suppression and loss of the moiety of each of the paired organs of the "Pallial complex" and its return to the rear of the animal had scarcely or only just begun.

The *Streptoneura* the most typical Gastropods, are at this period the sole representatives of the Molluscan stem, are normally an operculated group, and have from the earliest period been dominants of their class, but are now apparently giving way to the Euthyneures.

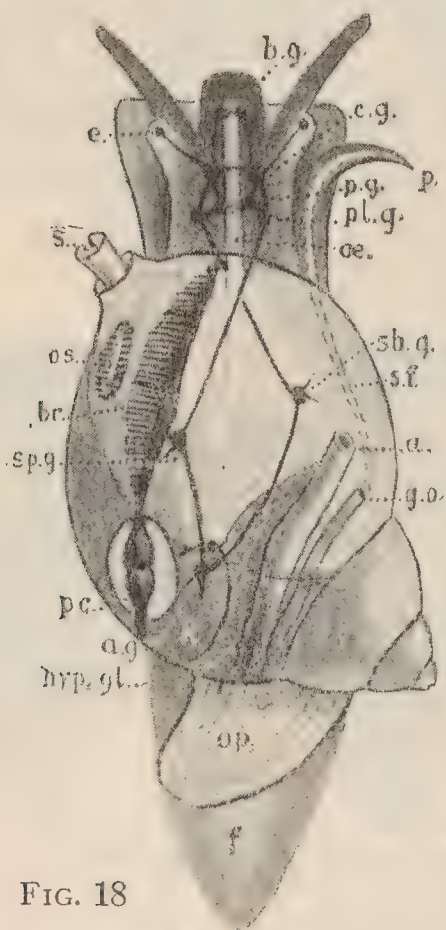


FIG. 18

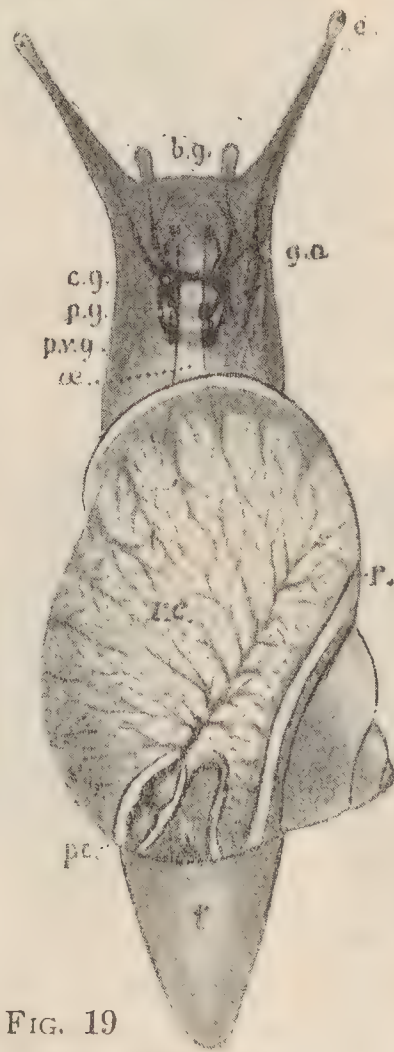


FIG. 19

Fig. 18—Schematic figure showing the arrangement and character of the internal organs in the Azygobranchiate Streptoneura (after Lang.).

Fig. 19.—Schematic figure showing the arrangement and character of the internal organs of *Helix aspersa* as typifying the Euthyneura.

a.g. abdominal ganglion; b.g. buccal ganglia; c.g. cerebral ganglia; p.g. pedal ganglia; pl.g. pleural ganglia; p.v.g. pallio-visceral ganglia, representing the long twisted nerve cords and ganglia of the Streptoneures; sb.g. subintestinal ganglion; sp.g. supraintestinal ganglion; e. eye; os. osphradium; a. anus; oe. oesophagus; k. kidney or nephridium; r. rectum; g.o. genital orifice; p. male organ; s.f. seminal furrow; br. branchia; pc. pericardium, enclosing the heart; s. siphon; r.c. lung chamber, showing blood plexus; f. foot; hyp.gl. hypobranchial gland; op. operculum.

The organization of the *Streptoneures* is chiefly characterized by the second body torsion which resulted in the crossing of the Visceral nerve-loop and the transfer of the "pallial complex" from an antero-ventral to an antero-dorsal position.

The *Euthyneura* are derived from the *Streptoneura* and formed by the unwinding or detorsion of the preceding torsions of the Visceral nerve-loop and the organs of the "Pallial complex" and returning them to their original and primitive position at the rear of the body, this movement has also the effect of bringing about the atrophy of one half of the organs of the "Pallial complex," that were originally paired and brings about a secondary simplicity of the organs.

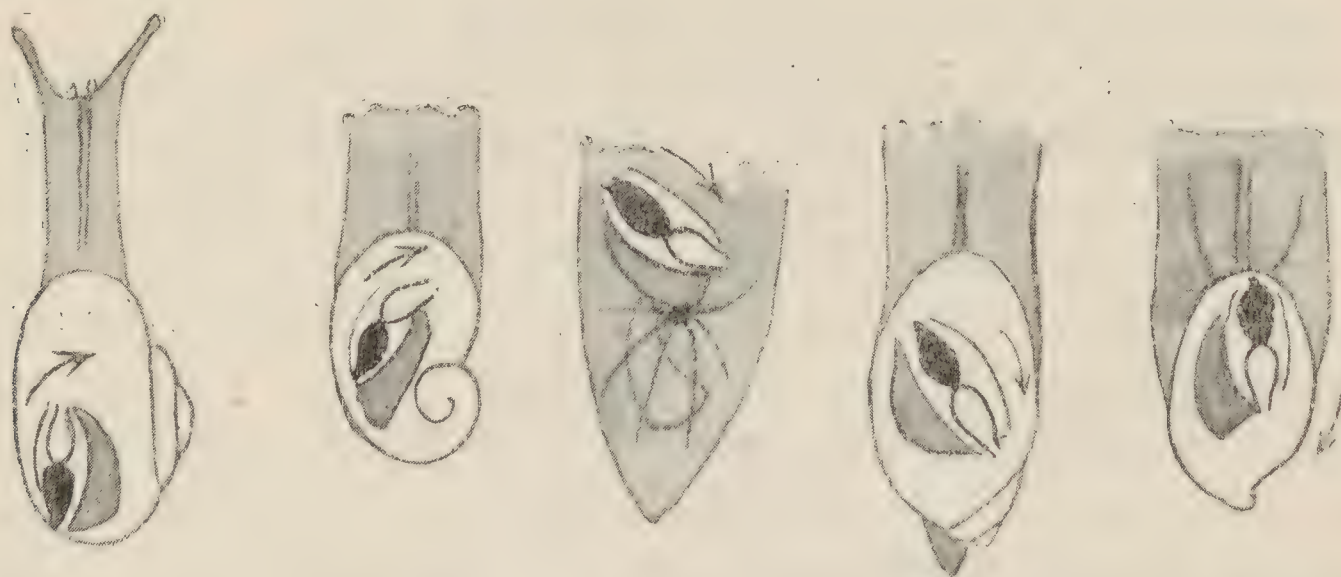


FIG. 20

FIG. 21

FIG. 22

FIG. 23

FIG. 24

Diagrammatic figures showing the detorsion or unwinding of the "pallial complex" or visceral sac, and its progressive stages in the various groups (after Watson).

Fig. 20—*Hyalinia* or *Rhytida*; Fig. 21—*Daudebardia*; Fig. 22—*Apera*; Fig. 23, *Strebelia*; Fig. 24—*Testacella*

The arrows indicate the direction of the rotational movement.

Undoubted *Euthyneures* first appeared in a transitory condition during Carboniferous times in *Actæonidæ*, occupying an intermediate or transitional position between the *Streptoneures* and *Euthyneures*, as the untwisting of the Visceral-loop is not quite completed, thus confirming the view that the *Streptoneures* are the most primitive, and that the simplicity of the *Euthyneures* has been secondarily acquired. The genus *Scaphander* which is truly Euthyneurous occurs in the Trias, and *Philinidæ* the assumed ancestors of our present day *Helicidæ* and *Limnæidæ* are found in Cretaceous strata.

Our BRITISH LAND AND FRESHWATER MOLLUSKS, now living on land or in freshwater were probably originally derived from the ocean, and when studied as to their history may be divided into several groups, based upon their different modes of life, whether inhabiting the land and breathing air, or dwelling in water with a water-breathing organization, or it may be as in the *Limnæidæ*, etc., which are now secondarily more or less aquatic in habit, though still retaining in a large measure the air-breathing organs, acquired during their antecedent terrestrial life, while we have at least one species which is relinquishing land life and directly re-entering the sea and re-assuming a marine life.

As an illustration of the actual method by which this change from a marine to a terrestrial habit or mode of life may be accomplished, I may recall the important comparative study of the *Littorinæ* by Prof. Tattersall, who has convincingly demonstrated the various evolutionary changes which they are undergoing upon our own shores.

The four species *Littorina littorea*, *L. obtusata*, *L. rudis*, and *L. neritoides* have been shown by him to characterize these structural and habitudinal stages; *L. littorea* being the most primitive, and *L. neritoides* the most specialized for land-life.

This result is being accomplished by the gradual abbreviation of the developmental processes, and the eventual complete suppression of the free-swimming larval stages, which in the more evolved species are now quickly passed through within the ovum; there is also developed within the pallial cavity a richly vascular area for aerial respiration.

Littorina littorea, the least modified of the group, lives in the zone characterized by the growth of *Laminaria* and *Fucus serratus*, and is uncovered only at extreme low-water of our spring-tides. The eggs are each enclosed in a floating gelatinous capsule and are shed singly but not affixed to stones or other objects, they are hatched as Trochophores or the early Veligers in the early summer months and form a prominent feature of the pelagic life of our inshore waters.

Littorina obtusata is a little further advanced towards a terrestrial organization and life. It lives in shallower waters than *L. littorea*, and differs in depositing its egg-capsules in masses attached to weeds, while the early Veliger or Trochophoral stage still seen in *L. littorea* is suppressed and the eggs hatch as fully developed Veliger larvæ, and the free-swimming life is comparatively short. *L. obtusata* lives in the zone of *Fucus vesiculosus* and *Ascophyllum nodosum* and is practically exposed at every low water tide.

Littorina rudis is still further advanced, having acquired a viviparous habit, the free-swimming stage being quite suppressed, is now quickly accomplished within the ovum. *L. rudis* inhabits the still shallower zone of *Pelvetia canaliculata* and *Fucus platycarpus*, which is near the high-water mark of Neap tides and therefore exposed the greater part of every day.

Littorina neritoides has also assumed the viviparous habit, the young being born in the adult form, and it has also suppressed the free-swimming larval stage. It inhabits the still shallower zone between the high-water-mark spring tides and the high-water-mark neap tides and is thus often exposed for days at a time, during which it is only moistened by the spray. The *L. rudis* and the *L. neritoides* are now becoming slowly and gradually diffused on the land.

[To be continued].

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THE "MUTATIONS" OF OUR NATIVE LAND AND FRESHWATER MOLLUSCA.

BY JOHN W. TAYLOR, M.Sc.

(Presidential Address delivered at the Jubilee Meeting, October 16th, 1926).

[Concluded from p. 96].

The FIRST GROUP is formed of genera which probably arose in the ocean, but have relinquished their residence therein, and become adapted to a freshwater habitat. This migratory process is still in active operation, especially where the sea is less saline than the ocean generally, and thus facilitates the change from an oceanic life to a freshwater or terrestrial existence; such regions are the Baltic, the Mediterranean, and other seas and the estuarine areas generally.

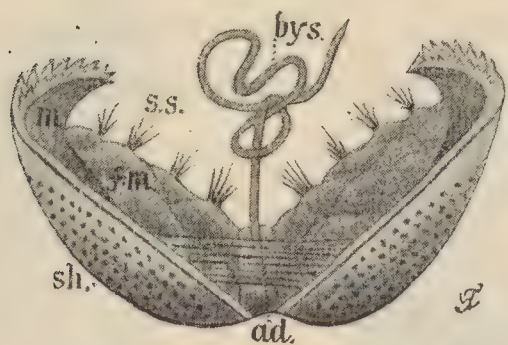


Fig. 25

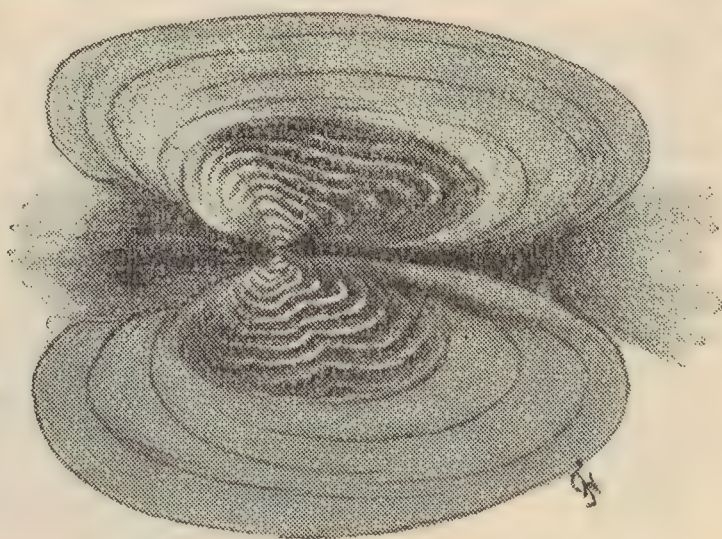


Fig. 26

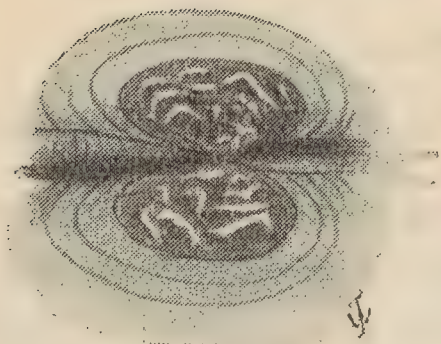


Fig. 27

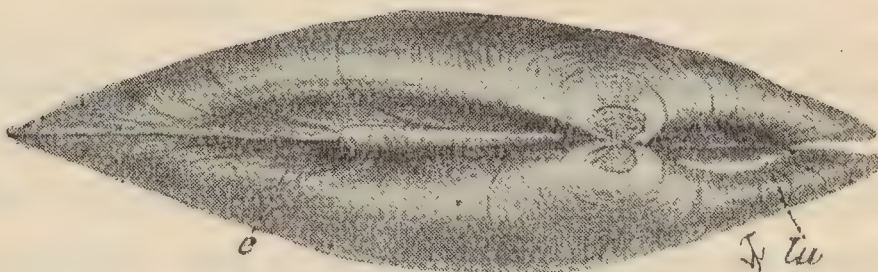


Fig. 28

FIG. 25—The Prodissoconch or Glochidium, the Primary Larval Shell of *Anodonta cygnea* (L.) (modified after Balfour).

FIG. 26—The Secondary Shell of *Anodonta anatina* (L.) showing its characteristic umbonal sculpture, differing from that of the tertiary or most modern part of the shell as well as from that of the preceding glochidial stage.

FIG. 27—Umbones of *Unio tumidus* (Phill.) $\times 2$, showing the nodules and nodular ridges characterizing the Secondary Shell, the Tertiary stage is indicated by the concentric striation.

FIG. 28—*Anodonta anatina* var. *complanata* (Rossm.) from Tenby, showing the position and relative sizes of the Secondary and Tertiary shells.

sh. Shell showing its porous structure; ad. adductor; bys. byssus; s.s. sensory setae; l. lunule; e. escutcheon; m. retractor muscle of apex of shell.

This group includes all the Pelecypods, as their form and organization are not adapted to an active terrestrial life; all bury their shells more or less deeply in the muddy and sandy bottoms of our flowing and stagnant waters; this mode of life finds its most extreme development in the ocean, the Mollusks penetrating deeply in sand and mud or perforating stone, wood or other hard materials, developing elongate siphons for respiratory or feeding purposes. These, our most strikingly recessive genera, are the less successful in life's struggles, for their tendency is towards a stricter adjustment to their special life conditions.

The *Anodontæ* may be regarded as typifying the *Unionidæ* or *Naiadaceæ* and are, with other Bivalves, more or less probably retrogressive in character, but display three successive phases of shell evolution. The first or Primary shell formation is the Glochidium stage, which in this group is parasitic for a period upon the gills and fins of fishes, upon which organs they become temporarily encysted, and pass through certain stages or metamorphoses which when completed are followed by the Secondary growth stage, the relinquishment of the parasitic for a free life, and the evolution of an entirely new shell which is developed inside the Glochidial shell, which is also differentiated by the presence of numerous distinct pores through the shell substance, while the new Secondary growth has strong concentric ridges and forms the nucleus of the adult shell. The Tertiary shell, as the shell of to-day may be called, is usually of a smoother surface and finer striation than the earlier growths.

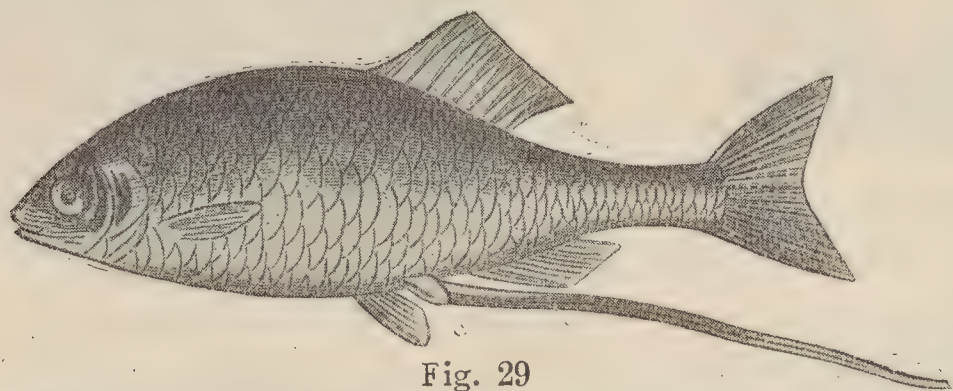


Fig. 29

FIG. 29—The Bitterling (*Rhodeus amarus*), parasitic in its earlier life period within the inner branchiæ of *Unio*, *Anodonta* and allied genera (after Siebold).

It is very remarkable that these developing glochidia are parasitic temporarily on fishes: there is a kind of Minnow (*Rhodeus amarus*) known as the Bitterling, which on the continent is parasitic on the *Unionidæ*, especially *Unio pictorum*, making use of the marsupial chambers of the inner gill of the mussels as a nidus for the safe hatching out of the ova which the parent fish deposits within the exhalent respiratory siphon of the mollusk by means of a long ovipositor which is temporarily developed for the purpose during the breeding season.

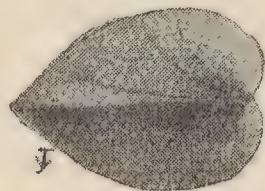


Fig. 30

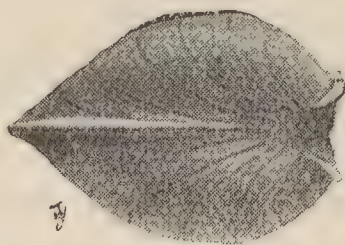


Fig. 31

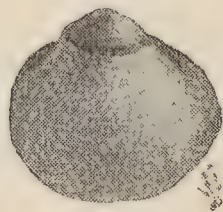


Fig. 32

FIG. 30—*Sphaerium pallidum* (Gray), showing the assumed first or Primary Shell, on the umbones of the later developed Secondary Shell.

FIG. 31—*Pisidium henslowanum* (Sheppard), showing the appendages on the umbones of the shell, and assumed to belong to the Primary or first stage of growth.

FIG. 32—*Pisidium nitidum* (Jenyns), showing the assumed first or Primary Shell and the Secondary continuation.

The genera *Sphaerium*, *Pisidium*, etc., also show similar evidences of the early evolution of a Primary shell and its eventual degeneration and almost total loss, but after a variable period of time the

mantle again exercises its power of evolving a new or secondary growth often different, yet in apparent continuity with the vestiges of the previously possessed Primary shell.

In *Sphærium lacustre*, *Pisidium henslowanum*, *P. nitidum*, etc., the embryonal or Primary portion of the shell is often (though not always) more globose than the Secondary growth.

Dreissensia is externally only a slightly modified form of the marine group *Mytilus* and among other things differs from the typical *Unionidæ* in being Heteromyate or possessing unequal adductor muscles and a functional byssus.

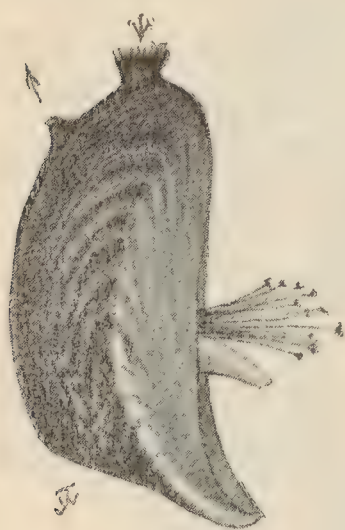


Fig. 33



Fig. 34

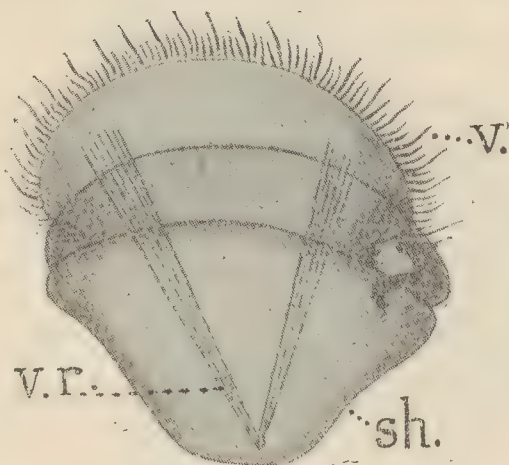


Fig. 35

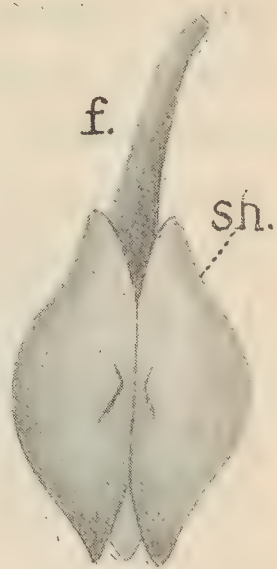


Fig. 36

FIG. 33—*Dreissensia polymorpha* (Pallas), the adult form and showing the retrogressive and digitiform vestigial foot and the byssus.

FIG. 34—The veligerous or active locomotory stage of the larva showing the extended Velum and the Primary shell (after Korschelt).

FIG. 35—The veligerous stage showing the extended Velum with its retractor muscles and Primary shell (after Korschelt).

FIG. 36—The final stage in the development of the Primary shell and the greatly elongated locomotory foot (after Korschelt).

sh. The Primary shell; v. the Velum extended; v.r. retractors of Velum; f, the fully developed foot.

Dreissensia though now normally inhabiting fresh-water still retains the free-swimming larval stage characteristic of the former marine life, and develops a protective shell; this is the Primary shell and is described as being almost circular in outline and resembling that of a young *Sphærium*. These larval Trochophores or Veligers are found in immense numbers during the summer months, swimming actively on the surface of the water, after a time the larvæ sink to the bottom, the Velum disappears, the foot elongates and the formation of the Secondary shell becomes initiated.

Dreissensia polymorpha was first noted alive in this country in 1834, and has since rapidly spread over the kingdom, this being probably due to the inauguration of the canal system for inland navigation, which constituted ideal conditions for the free swimming larval forms by providing against the larvæ being swept into the sea by the swift flow of the rivers.

This SUB-SECTION embraces almost all our operculated Gastropoda as *Vivipara*, *Bithynia*, *Valvata*, *Neritina*, etc., all of which retain in a more or less modified condition, the primitive branchiæ and the associated sense organs or osphradia. They also have been verified to conserve frequently at the apex of their shells the Protoconch or vestigial remnants of the shell or shells they formerly possessed.

The *Viviparidæ*, which may represent the present sub-section, is an ancient family of mollusks which is widely distributed over the earth.

Vivipara contecta is chiefly European in its range and is recorded in the fossil state from the Pliocene deposits of West Slavonia by Prof. Sandberger. It is a viviparous species, the young when born bearing a shell of four whorls, depressly globose in shape and 5–7 millimetres in diameter. This is probably the Secondary shell, possessing on the median peripheral zone three spirally parallel rows of stout and strong bristles, the upper row being notably the strongest. The whole surface of the last or body-whorl is covered with numerous fine, spirally parallel groovings, alternating with a corresponding number of spiral parallel rows of minute cilia, this complicated arrangement would appear to indicate a spinose, sculptured or hispid ancestor.

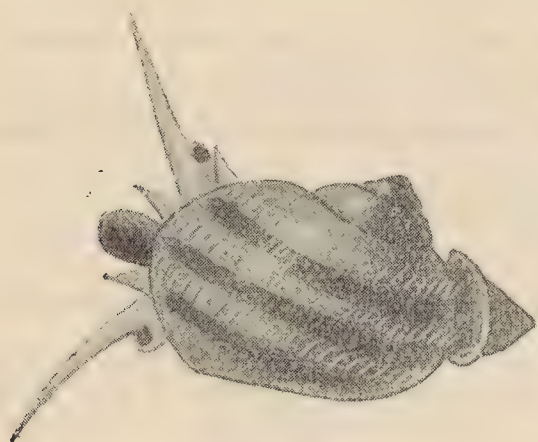


Fig. 37

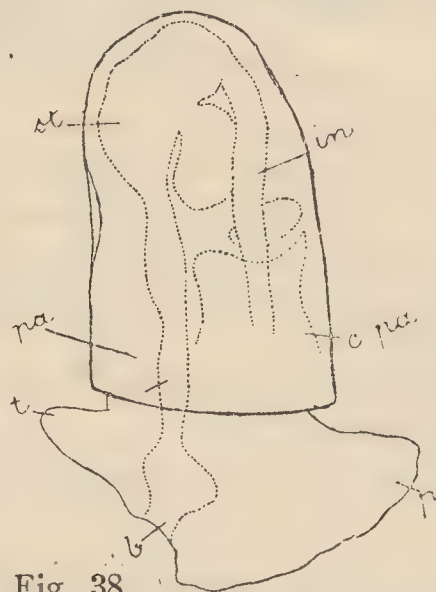


Fig. 38

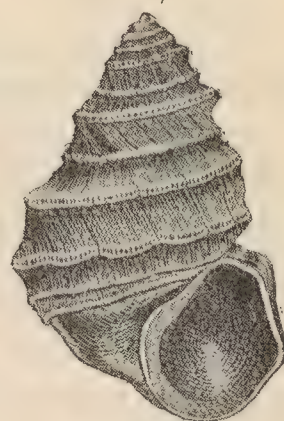


Fig. 39

FIG. 37—Newly hatched *Vivipara contecta* (Millet,) $\times 3$, from a nature sketch in April, 1883.

FIG. 38—Embryo of *Vivipara vivipara* (Linné), viewed from left side, showing the simple cup-shaped Primary shell (after Drummond).

FIG. 39—*Vivipara neumayri*, a suggested ancestral form, from the Pliocene *Vivipara* deposits of West Slavonia (after Simroth).

b. mouth; cpa. pallial cavity; in. intestine; p. foot; st. stomach; t. tentacle.

This bristly and ciliated investment extends over the whole surface of the last whorl, becoming weaker on the penultimate whorl and towards the base of the shell and apparently due to corresponding fleshy outgrowths of the mantle margin and quite unlike the smooth green or brown shell of the Tertiary stage.

The earliest known form of the first or Primary shell is the smooth cup-like form which characterizes the Trochophoral stage.

There is also a marked sexual dimorphism in the adults, which in the males have the right tentacle thickened and deformed by association with the penis; moreover, Simroth has figured the male as possessing a bifasciate shell, while the female is depicted as three-banded.

The SECOND GROUP, also primarily, emanated from the ocean, and possessed the pectinate gill or ctenidium for water-breathing, and the associated osphradium, but later in their life-history they invaded the land and adopted a terrestrial life, gradually modifying their water-respiring organs into a richly vascular plexus of blood-vessels, spread over the roof and walls of the pallial cavity for the respiration of free-air, but traces of the former existence of pectinate gills and osphradia can be detected in the adults, and can also be demonstrated in the embryo, and testify to their former aquatic existence.



Fig. 40

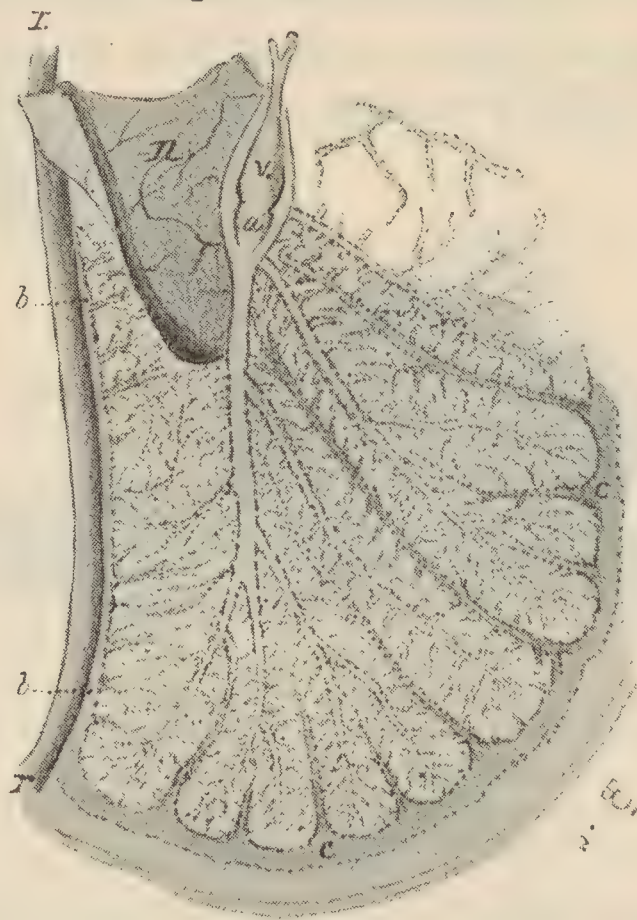


Fig. 41

FIG. 40—Gill or Ctenidium of *Vivipara* showing the Pectinibranchiate Gill as a type of the primitive aquatic respiratory organ and representing the First group (after Lankester).

br. branchiæ, composed of rows of elongated filaments; *i.* rectum; *a.* anus.

FIG. 41—Diagram of air-breathing organ or lung of *Helix aspersa* which supersedes the Gill or water-breathing organ in the First group.

a. and *v.* the auricle and ventricle of the heart; *r.* the rectum; *n.* kidney and ureter.

The darker veins carry the impure blood to the surface of the lung for aëration, while the lighter ones re-collect the blood after purification and convey it to the auricle.

The various genera of the *Helicidæ* and other groups fall into this division, as *Limacidæ*, *Arionidæ*, *Enidæ*, *Clausiliidæ*, *Pupillidæ*, *Cyclostoma*, *Acme*, etc. These groups in many cases retain the Protoconchs or vestiges of one, two or even three former and successively functional shells, the precursors of the shell now possessed.

This section may be regarded as the most advanced and progressive assemblage, consisting in large measure of the most dominant, active and alert members of their class, while the change from an aquatic life to a terrestrial habit and atmospheric respiration is fatefully important as air is practically thirty times richer in oxygen than water and therefore confers greater energising power.

As justly observed by Dr. F. A. Bather "successful forms imply no secure station, but the highways of progress as opposed to blind alleys" and deterioration.

The **Helicidæ** may be regarded as representative of the Gastropoda amongst the land mollusca, the genera and species being numerous and dispersed throughout the globe.

Those genera and species inhabiting the European region are generally more advanced in organization and of a higher status than those of other areas, and are classified as *Belogona Siphonadenia*, a group which embraces the *Pentatænia*, which are probably the most highly developed Helices in the world, and may be likened to the white man, in their relative superiority to other races, and possessing the same power and ability to colonize other lands and dispossess the original occupants.

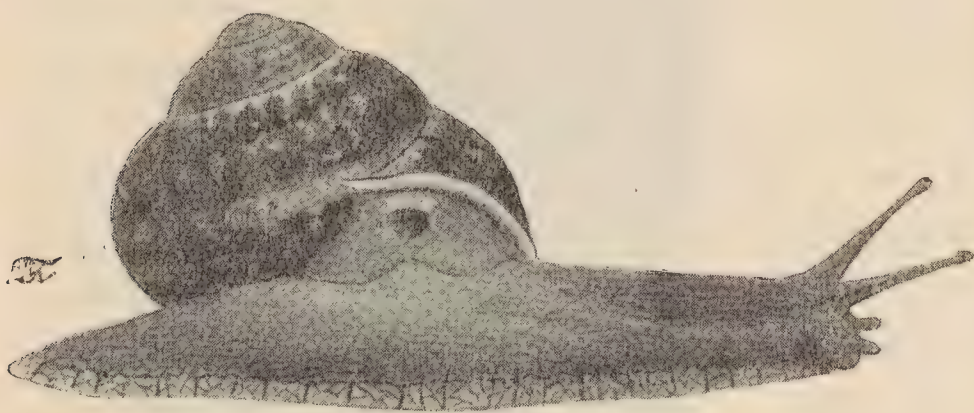


Fig. 42

FIG. 42—*Helix aspersa*, typifying the second group, and showing the external aspect of the animal and its shell, and especially the respiratory aperture, the lateral sinus and tentacles.

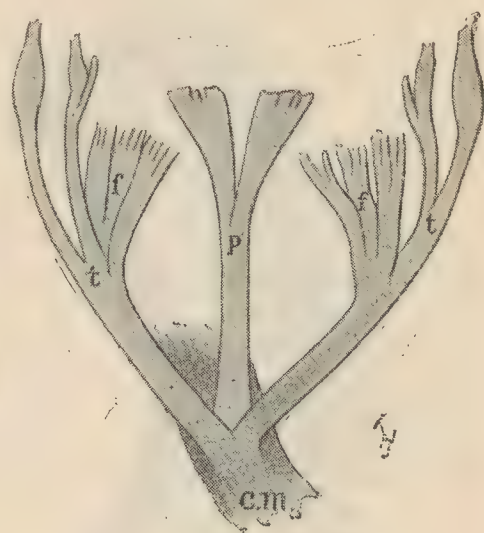


Fig. 43

FIG. 43—Retractor muscles of the head and tentacles of *Helix aspersa* (Müll.) $\times 4$.

c.m. columellar muscle; f. anterior foot retractors; p. retractor of the pharynx; t. the tentacular retractors.

Naturally all are not equally endowed with these predominating powers, and the numerous Families, Genera, and Species which fail, more or less, in the struggle for existence to which all organisms are committed, must migrate to other districts or adapt themselves to some other mode of life.

The most highly developed forms of this group are exemplified by *Helix aspersa*, *H. pomatia*, *H. nemoralis*, etc., and they are specially distinctive of Western Palæarctica, yet certain of the earlier evolved and more simply organized forms have penetrated eastward as far as China, and represent the advancing wave of superior life, which is pressing upon the rear of the preceding and formerly dominant *Euadeniate* race, which although now a waning group in Palæarctica, is still the most dominant Helicidian group in America, where it is found along the Pacific coast of that continent and penetrating to South America and the Greater Antilles.

The **Testacellidæ** as typified by *T. haliotide*a is a group which has adopted a predatory and largely subterranean life, probably as a result of the struggle for existence, which is ever in progress and impels the less successful species or groups to migrate to other districts, or adapt themselves to other foods and other modes of life.

Amongst other changes *Testacella* now preys chiefly on earthworms, following them into their burrows and devouring them there. This mode of life has been rendered more feasible by the development of great changes in the radular teeth, which have become large, strong, and distinctly barbed to ensure a secure hold of their prey, assisted by the unusually powerful and numerous retractor muscles of the pharynx. An additional air reservoir has also been evolved adjacent to the pallial cavity and which is available for respiration during their pursuit of worms within their burrows.

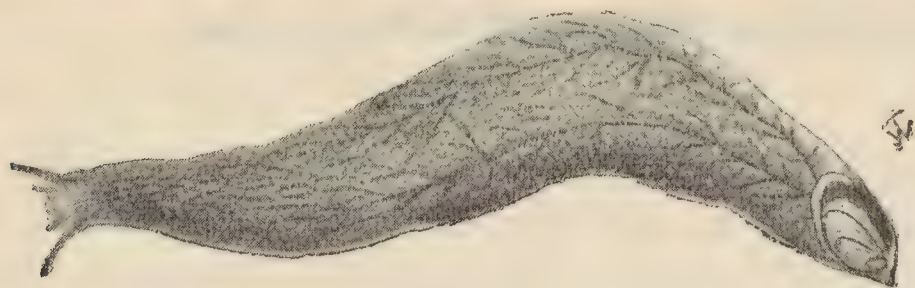


Fig. 44

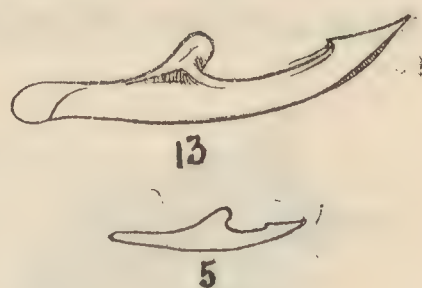


Fig. 45

FIG. 44—*Testacella haliotidea* (Drap). Oxford: Prof. E. B. Poulton.

FIG. 45—Isolated Teeth from the fifth and thirteenth longitudinal row of the radula of *T. haliotidea* $\times 40$.

The shell, in accord with the mode of life, has been diminished greatly in size and the sculpture of the secondary shell is more strongly marked than the nuclear whorl of the embryonal shell which forms its apex.

The *Limacidae* or slugs are not a homogeneous group but undoubtedly Polyphyletic, being referable to several distinct genera, which, by convergent development, have arrived at a similar stage of shell degeneration and consequently acquired a superficial external resemblance. In structure, the genera *Limax*, *Milax* and *Agriolimax* show little natural affinity.



Fig. 46

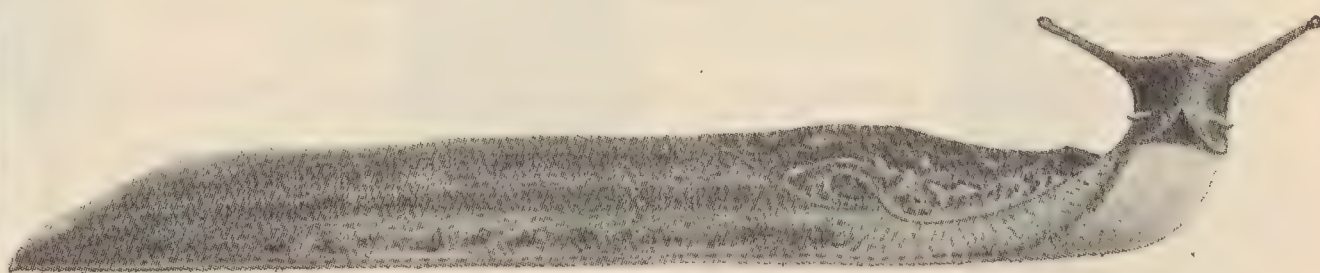


Fig. 47

FIG. 46—Internal decedent or vestigial shell of *Limax maximus* (L.) $\times 2$, Christchurch, Hants.—C. Ashford.

FIG. 47—*Limax maximus* var. *sylvatica* (Morelet), Well Vale, Lincolnshire.

The shells, however, are approximately of the same stage of degeneration, being now reduced to a somewhat flat calcareous plate, quite hidden by the shield or mantle, but which in some of the genera still furnishes undeniable evidence of the former possession of a spirally-coiled shell into which it could probably retire for protection or rest. At another and still earlier period they were truly aquatic animals.

The *Arionidæ* are our only non-marine mollusks which have almost lost all traces of the external shell they formerly possessed, as the vestigial chalky pulp or granules are now completely enclosed within the mantle or shield, and the spirally-twisted alimentary tract indubitably indicates that they formerly possessed a spirally-coiled protective shell and probably an operculum also.

The *Arionidæ* are therefore not primitive forms, developing a nascent shell within the Shell-sac, neither have they been derived from some supposed sea-slug as some authors have suggested, but are a modern form and the culminating point of one line of development.



Fig. 48



Fig. 49

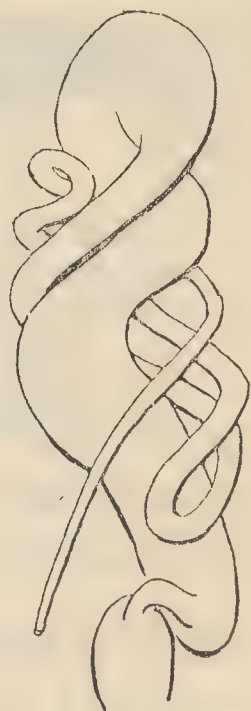


Fig. 50

- FIG. 48—*Arion ater* var. *rufa* (L.), Minden, Westphalia, collected by Hugh Richardson
 FIG. 49—Cephalic and the paired tentacular retractors of *A. ater* showing their separate origin, and differing thus from the *Limacidæ* and other slugs, $\times 2$.
 FIG. 50—Alimentary system of immature *A. ater*, showing the spirally twisted tract and its evidence of the former possession of an external and coiled shell.

The *Arionidæ* probably arose and attained their highest development in the European region, the most advanced area on the globe, but there are interesting aggregations of some of the more primitive and ancestral forms, which still linger in West American and other primitive regions, where is found *Binneya*, half slug and half snail, which, according to Dr. Pilsbry, forms the link connecting it with the fully-shelled *Endodontæ*, a very ancient group which has now its metropolis in the islands of the South Pacific Ocean.

In *Arion ater*, the typical and most advanced species of the group, there is now apparently in progress a movement which it is possible to regard as the initiation of the process of acquiring a new shell, the evidence of this is the deposition of lime particles within the cells of the arterial sheath and elsewhere, deposits regarded by Karl Semper as a temporary storage for some subsequent use. There is also a

dense calcareous deposit within the outer integument, which in some specimens has become so plentiful that the animal's movements are sensibly impeded and become slow, stiff, cumbrous and awkward, and in the absence of any definitely shaped Protoconch to form a nucleus or point of departure for a new shell formation, we may, perhaps, tentatively assume that the new shell will originate as a Patelloid form, and utilize the lime particles stored up in the integuments and viscera, and so start a new course of evolution and enter upon some analogous cycle of shell progress to that we assume it has gone through at least once in the past: that this is so is confirmed by embryological testimony.

Milax sowerbyi, seems more especially to have adopted a more or less subterranean mode of life, as also have certain of the *Arionidæ* and *Limacidæ*, as it is known to feed beneath the surface upon bulbs and other forms of plant-life found therein. Changes of structure will no doubt arise appropriate to that mode of life, and may have become initiated in the structure of the animal, as is so clearly displayed in *Testacella*.

The genus *Vitrina* displays the degeneration of the shell by the different species in varying degrees, but it is probable that many

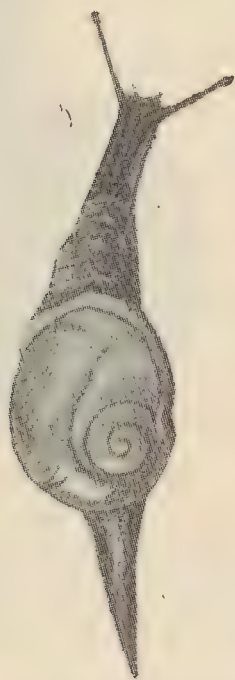


Fig. 51



Fig. 52



Fig. 53

Three species of *Vitrina*, showing the increasing development of the limacidian mantle or shield within which the deteriorating or decadent shell will eventually become enclosed (after nature sketches by J. Davy Dean).

FIG. 51—*Vitrina pellucida* (Müll.), Grange-over-Sands, J. D. Dean.

FIG. 52—*Vitrina major*, (Fér.), Cusop, nr. Hereford, Prof. A. E. Boycott.

FIG. 53—*Vitrina hibernica* Taylor, Collon, Co. Louth, Ireland, P. H. Grierson.

species, especially those of distant countries, have little blood-relationship with our shells, but are derived from many diverse genera which have merely reached a similar stage of shell degeneration.

In this group the approximation of the course of development towards the Limacidian form is very apparent, for not only is the

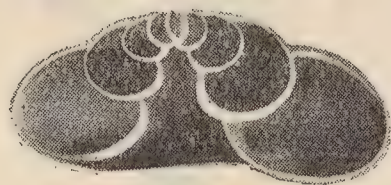
shell small, fragile and paucispiral, but it is now almost completely enveloped by the mantle-lobes, and is evidently nearing the last stage before becoming fully enclosed within the incipient shield or mantle, which is already partially formed for its reception, and which when completed will be exactly as we see it in *Limax* at the present day.

The verity of the decadence of the shell is shown by its delicacy and fragility, and by the comparatively bulky body of the animal, which can no longer (except in dry weather) be fully withdrawn within the shell.

The group **Hyalinia** resembles *Vitrina* in being composed of a number of species probably of diverse phyletic ancestry, which are of very different structure, but by convergence of their shell characters are all now passing through the same, or practically the same stage of decadence, evidenced by their similar fragile and transparent aspect. That they were probably not always so delicate in shell-substance is shown by the greater amount of calcification still existing in the basal region of the shell, and clearly discernible by its whiteness and



Fig. 54



F.g. 55

FIG. 55—Section through the shell of *Hyalinia (Polita) nitidula* (Drap.) $\times 3$, showing the calcareous thickening of the shell substance in the umbilical region (section cut by Mr. F. Rhodes).

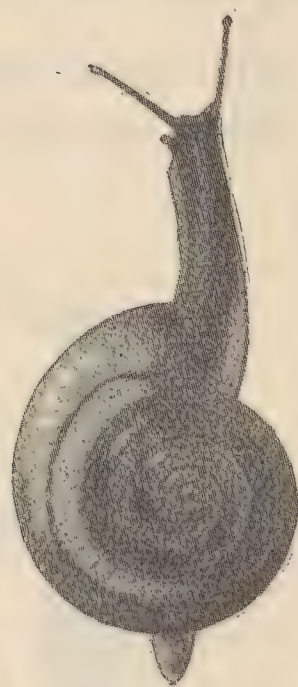


Fig. 56

FIG. 54—*Hyalinia helvetica* (Blum) $\times 2$, Malham Cove, Yorkshire (from nature sketch by J. Davy Dean).

FIG. 56—*Hyalinia (Polita) nitidula* (Drap.) $\times 2$, Silverdale, Lancashire (J. D. Dean).

opacity, and reminiscent of the more solid and substantial shells they in all probability formerly possessed. This feature of the persistence of ancient characters is often well displayed by *Polita nitidula*, *Hyalinia lucida*, etc. The North American close allies of *Hyalinia*, which are probably more primitive than the European species, display this thickening of the shell substance much more strikingly than our native species, as is especially exemplified by *Zonites demissus* in whose shell there exists a strong, thick and white calcareous deposit inside the base of the last whorl, with several radial nodular thickenings which represent the teeth and folds seen in *Gastrodonta lamellidens*.

These nodular and other thickenings are now always best developed in adolescent shells, as they disappear or become smaller and the deposit thinner in the adults, which is powerful evidence of the decadence of this deposit and the truth of its former existence in a fully developed condition.

Zonitoides is an interesting and probably a recessive group, and in this country has always been classified under *Hyalinia*, but its affinities are probably with *Gastrodonta*, *Ariophanta* and other related exotic genera. There are two representative species in this country, *Z. nitidus* and *Z. excavatus*, which are, however, following divergent and diametrically opposite habits and evolutionary direction.

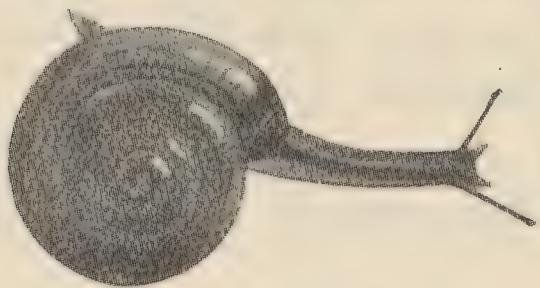


Fig. 57

FIG. 57—*Zonitoides nitidus* (Müll.) $\times 4$, Lancaster (J. D. Dean).

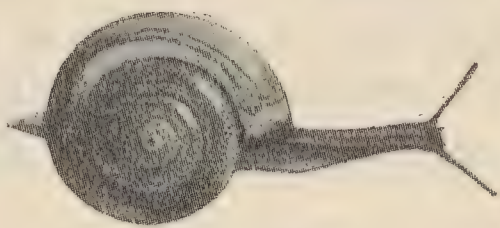


Fig. 58

FIG. 58—*Zonitoides excavatus* (Bean) $\times 4$, Lower Wyresdale, Lancashire (J. D. Dean).

Zonitoides nitidus is tending towards the aquatic life and now lives exclusively in wet and marshy places, and is clearly on its way to a water life, while *Z. excavatus*, on the contrary, frequents dry and barren woodlands, etc. on non-calcareous ground and is becoming more and more noticeably subterranean in its habits, burying itself deeply amongst the accumulated layers of dead leaves, etc. in the woods.

The *Vitrea* represented by *V. crystallina* is evidently a retrogressive form becoming more and more impelled to a subterranean life, and will become further modified in harmony with that mode of life. The var. *subterranea*, regarded by many scientists as a distinct species, lives largely buried in the soil. It is duller in aspect, smaller in size, and stronger than the ordinary crystalline form.

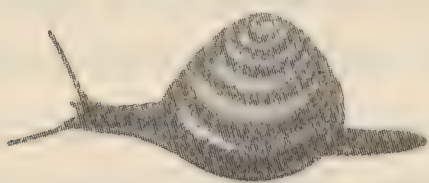


Fig. 59

Fig. 59—*Hyalinia (Conulus) fulva* (Müll.) $\times 8$, Shipley Glen, Yorkshire (F. Booth) (J. D. Dean).

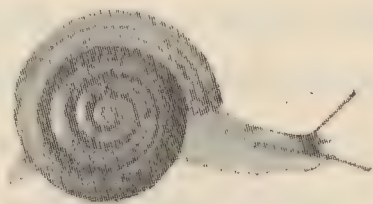


Fig. 60

FIG. 60—*Hyalinia (Vitrea) crystallina* (Müll.) $\times 10$, Shipley Glen, Yorkshire (F. Booth) (J. D. Dean).

The group *Conulus*, is represented, in our own country, by a single small species, *Conulus fulvus*, remarkable for its very wide distribution in the Northern hemisphere and for the occasional development of a series of small calcareous denticles, radially disposed on the inner base

of the last whorl, and visible outwardly through the shell, while they are of exactly the same character as those of *Gastrodonta lamellidens*, to which group it probably belongs.

This peculiar apertural armature is in this species restricted to young and adolescent individuals and has been regarded by Dr. Sterki as nascent or in progress of acquirement and named var. *dentata*. This feature disappears in the adult and is exactly paralleled by *Pupa umbilicata*. The atavic nature of this peculiarity is rendered still more probable by its occurrence in the less favourable hilly regions of Alabama, while specimens from the richer lower grounds show no evidences of this internal calcification in old or young.

In *Pupidae* is further evidence of the uneven pace of the evolution, or mutation, of specific or generic characters, those with the more active developmental impulse, as say *Pupa umbilicata*, which has now only a small parietal denticle at the aperture of the shell, but



Fig. 61

FIG. 61—*Pupa umbilicata*, showing the adult shell and the various stages of the mutational changes from birth to adolescent stage of the internal calcareous lamellæ and denticles.

a. frontal and basal aspect at birth; *b.* basal aspects showing a little further development of the lamellæ; *c.* the five-whorled stage, showing the basal aspect of the radiating calcareous lamellæ; and *d.* frontal aspect of the same stage.

formerly when adult possessed a complex apertural armature similar to that which *Pupa anglica* still retains, but which in *Pupa umbilicata* is now restricted to the young and adolescent stages of life as they are totally and completely absorbed before full maturity is attained—*P. umbilicata* is a modern group, with active mutational energy, while *Pupa anglica*, is the more primitive species and mutationally slower.

M. Bourguignat, who has studied the interesting development of *Pupa umbilicata*, states that when born they have a depressed and widely umbilicated shell with two whorls and bearing two strongly developed, calcareous spiral lamellæ, one on the parietal wall and the other winding around the columella.

On attaining the fifth whorl modifications arise which result in a turriculate shell, the umbilicus becomes contracted, the bodywhorl subcarinate and the two spiral lamellæ become stronger and more prominent.

A mutation is set up by the gradual building up of three or more thick, cretaceous and very prominent radiating lamellæ on the inner surface of the basal whorl, and visible through the shell, simulating the similar radial divisions occurring in *Segmentina* and certain *Hyalinia*.

After the fifth whorl, all these peculiarities are lost and no trace of them has been detected in adults. The apertural denticle of the adult is a new formation, quite disconnected with the lamellæ and radial processes of the adolescent shell.

The *Clausília laminata* and other species of the group conserve the Protoconch as the initial whorls of its secondary shell, and these whorls are proportionately and actually noticeably larger and more tumid than they would be if in proportion with the entire shell; they are also different and, according to Pelseneer, are not constructed on the same "spiral radial." It is also stated that the minute vestigial shell is enclosed within the epithelium of the mantle, as in *Limax*, but that this is soon ruptured and the Protoconch becomes external and forms the apex of the secondary shell, which is formed in continuity with it.



Fig. 62

FIG. 62--Section through mantle of *Cyclostoma elegans* showing the vestigial folds of the deteriorating and decadent gill or branchia (after Garnault).



Fig. 63

FIG. 63--*Clausilia bidentata* (Ström) showing the clausium "in situ," and the vestigial apex (section cut by Mr. F. Rhodes).

In *Cyclostoma elegans*, *Acme lineata* and *Carychium minimum* we have good instances of originally aquatic shells provided with the ctenidium or pectinate gill, for water respiration, and also with the osphradium, the correlated sensory organ, forsaking their native element and becoming adapted to a life on land, and largely losing their branchia and osphradium, of which, however, traces can be made out within the respiratory cavity.

The families *Acmeidæ* and *Carychiidæ* are diminutive forms which live in humid air, hidden under moss, decaying wood and leaves. *Acme* is largely subterranean in its habits, and frequently swarms on the mycelium of certain fungi on the roots of the Common Nettle (*Urtica dioica*) and other plants which permeate the ground.

The THIRD GROUP embraces those genera or species which, though originally inhabiting the water, afterwards relinquished aquatic life and gradually assumed a terrestrial habit, becoming pulmoniferous by the degeneration of the pectinate or comb-like gills and the accompanying osphradium, which are replaced by the vascularisation of the walls and roof of the pallial cavity adapting the respiratory chamber for air-breathing.

After ages of life on land these groups or species, probably the most important sections of which are the *Limnæa*, *Planorbis*, *Physidæ* and *Ancylidæ* are now seen in actual process of re-assuming aquatic life, while other groups or individual species are now following the same course, but are not as yet so deeply involved: the *Succineidæ*, *Zonitoides nitidus* and *Hydrolimax lævis* may be mentioned as illustrations.

This group and many other sections which are drifting with variable pace towards deterioration and a lower status and becoming truly aquatic animals may be very justly compared with the Seals, Dolphins and other amphibious animals which have been similarly modified for aquatic life, by acquiring new organs differing in form, position, or arrangement to those possessed in the far distant past, yet identical in function.

The *Planorbidæ* were also originally aquatic in habit and organized suitably for a water-life, but later in their history invaded the land and

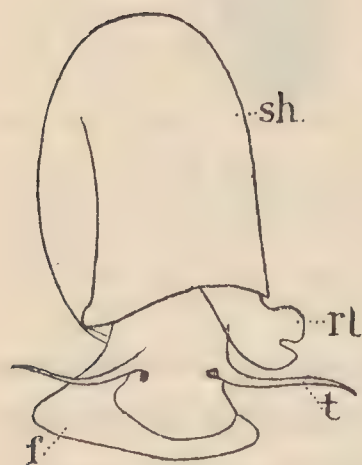


Fig. 64



Fig. 66

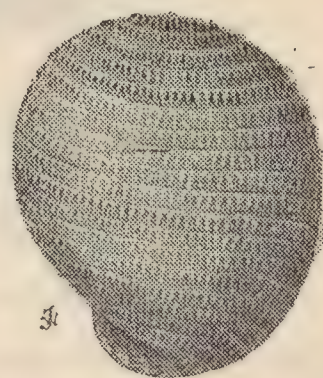


Fig. 65

FIG. 64—*Planorbis corneus* (L.) showing the slightly exserted auxiliary extensile lobe for aquatic respiration (after Pelseneer).

e. eye; *f.* foot; *rl.* respiratory lobe; *sh.* shell; *t.* tentacle.

FIG. 65—*Planorbis corneus* (L.) fifteen days old, $\times 12$, showing the spiral rows of periostacal hairs characteristic of the youthful stage (after an original drawing by Mr. G. Sheriff Tye).

FIG. 66—Extensible aquatic respiratory lobe, or secondary branchia of *Planorbis corneus*, showing its highly vascular structure $\times 12$ (after Pelseneer).

became pulmoniferous, the water-breathing organs degenerating, and those adapted to a terrestrial existence becoming evolved.

After an enormous period of land life they are now resuming the aquatic habit and are gradually developing, outside the pallial chamber, a secondary, richly vascular and extensile lobe for water-respiration to replace the now degenerate branchiæ and osphradia which were functional during their antecedent aquatic life.

This auriform respiratory lobe in *Planorbis* is proved, on close study, to be a comparatively modern organ, as its initiation is post-natal and has not been detected in the embryonal stage of growth.

The young individuals of *Planorbis corneus*, *albus*, etc. are finely and densely hirsute with a multitude of spiral rows of short, whitish hairs, possibly reminiscent of their functional development during their former terrestrial life, when they probably inhabited the moist, shady woods at some very remote period.

The **Physidæ** are also primitive aquatic species with pectinate gills and the accompanying osphradium, and though probably not really a homogeneous group, have all also passed through a lengthy period as land organisms, gradually acquiring an organization suited to that mode of life, while the branchiæ and osphradia have degenerated from disuse. Now they are reverting to an aquatic life, and though still largely pulmoniferous, have in *Physa fontinalis* developed a couple of lobes near the Pneumostome which are believed to be homologous with the auriform lobe of *Planorbis corneus*, and similarly organized for water respiration.

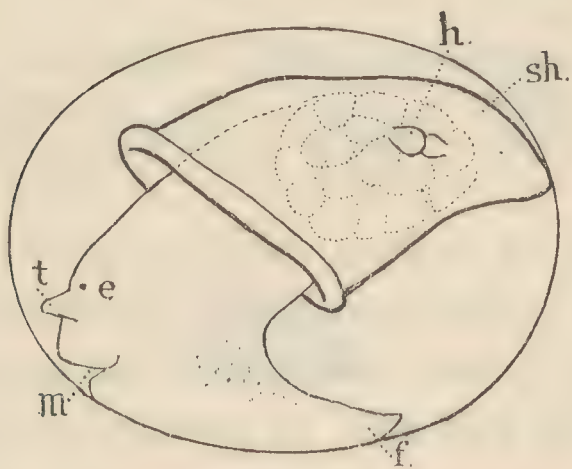


Fig. 67

FIG. 67—*Physa fontinalis*, the developing ovum, showing the embryo after the first or chief intestinal flexure (after Pelseneer).

e. eye; *f.* foot; *h.* heart; *m.* mouth; *sh.* shell; *t.* tentacles.

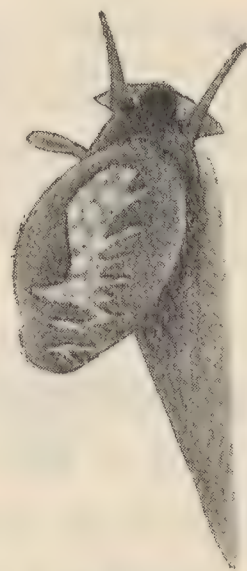


Fig. 68

FIG. 68—*Physa fontinalis*, adult, in active movement, and showing the digital expansions of the mantle margins which are enveloping the shell and also showing the extensile respiratory lobe or false branchia for the respiration of water (modified after Reeve).

Physa fontinalis is also undergoing the process of "Shell degeneration," not only by thinning of the shell substance but by a reduction in the size and number of its whorls, this being due to a great development of the mantle margin into a series of digital outgrowths

which almost completely envelop the shell when in motion, and cannot be completely retracted within it when at rest, as is also the case with the large foot. These digital expansions of the mantle are of comparatively recent origin, as they are not present in the embryo and are chiefly of post-natal development.

The *Limnæidæ* in the far distant past were water-residents, and suitably organized therefor, possessing ctenidia or comb-like gills within the pallial cavity for water-respiration, and in correlation therewith possessed the osphradium, a sensory organ guarding the entrance to the pallial-chamber.

In course of time the *Limnæidæ* relinquished their aquatic mode of life and invaded the land, and as a consequence of constant disuse the ctenidia and attendant osphradium gradually became degenerate, the walls and roof of the pallial chamber acquiring a richly vascular

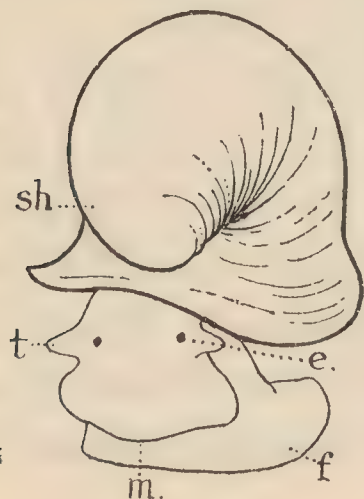


Fig. 69

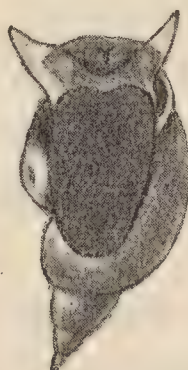


Fig. 70

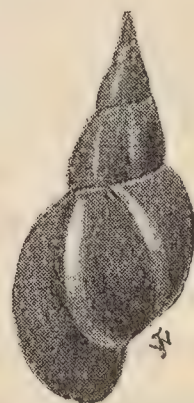


Fig. 71

FIG. 69—*Limnæa stagnalis* in the early stage of embryonal life, showing the origination of the primitive or exogastric mode of coiling of the shell (after Pelseneer).

e. eye; m. mouth; f. foot; sh. shell; t. tentacle.

FIG. 70—*Limnæa stagnalis* var. *fragilis* showing the air-breathing orifice closed before withdrawal, shows also the structure of the head region.

FIG. 71—*Limnæa stagnalis* var. *variegata* (Hazay,), Peffer Burn, Haddington, Rev. Dr. MacMurtrie.

network of blood-vessels and acting as a lung, while, according to Dr. Cæsar Böttger, the *Limnæa* may, under favourable circumstances, also evolve a superficial network of blood capillaries for auxiliary respiration even on or within the walls and roof of the buccal cavity.

This terrestrial life was probably followed for an enormous length of time, but eventually the creatures were impelled to re-assume their originally aquatic mode of life, and the constituent genera are now re-adapting themselves at a varied pace for the purpose.

In the genus *Limnæa* the pulmonary pouch still exists, but it is established that they can exist by respiration through the skin only, as is the case with the abyssal forms of *Limnæa peregra* and other species which exist at depths of upwards of 1000 ft. in the Lake of Geneva and elsewhere at great depths.

Prof. W. Roszkowski has averred that in *Amphipeplea* the highly developed mantle-lobes which envelop the shell have a very important share in the respiration and that the exercise of this function is the cause of the great development of the mantle. The shell is, however, undergoing degeneration or absorption and is now a mere film, and so reduced in size as to be quite unable to shelter or protect the animal.



Fig. 72

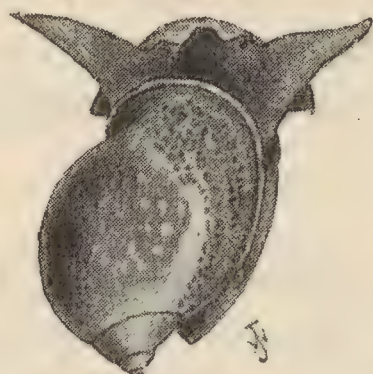


Fig. 73



Fig. 74

FIG. 72—*Amphipeplea glutinosa* with the mantle fully expanded and almost entirely covering the decadent and fragile shell.

FIG. 73—*Limnæa peregra* var. *ovata* (Drap.) as representative of the air-breathing aquatic mollusca from River Torne, Doncaster.

FIG. 74—*Limnæa peregra* at water-surface during aerial respiration.

The shells of the *Ancylidæ* are now in a degenerate or senile stage of their existence, they were originally spirally coiled shells, but the volutions are now almost completely unrolled and they have also lost the pallial or respiratory cavity.

The *Ancylidæ* are allied to the modern *Planorbis* and were probably derived from Planorboid ancestors, this probability being suggested in *Ancylus fluviatilis* by the vestiges of a sinistrally Planorboid shell of 2-3 whorls, being occasionally perceptible at the apex of the shell. This feature is shown well by the more primitive *Ancylus cumingianus*, a native of the southern hemisphere, and by *Brondelia gibbosa* of Bourguignat from Algeria.

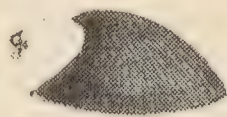


Fig. 75

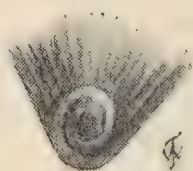


Fig. 76

FIG. 75—*Ancylus fluviatilis* (Müll.), Swarraton, Hants, Rev. W. L. W. Eyre.

FIG. 76—Apex of *Ancylus fluviatilis* var. *gibbosa* (Jeffr.), showing the sinistrally coiled Planorboid coiling of the vestigial or Primary shell (after Bourguignat).

Velletia, which is a dextrally organized, animal and shell, is of similar origin and is similarly modified, showing its kinship to *Planorbis* by its bifid median teeth and the peculiar digitate marginals of the radular armature.

In their originally aquatic existence they possessed the primitive gill and osphradium which, when existent, are invariably within the pallial cavity and of which organs traces can still be detected.

After ages of terrestrial life, with modifications for air-breathing, the *Ancylidæ* are resuming aquatic life and have, according to Pelseneer, adapted themselves almost completely to a water-life. They have not, as one might naturally suppose, re-adapted themselves for water breathing by reviving the structures they formerly possessed, but initiated the evolution of an auxiliary, highly vascular lobe, which is thin walled and permeable to oxygen, but is not within the pallial cavity which has been lost, but external to it, and serves for respiration in conjunction with the skin or integumental respiration which has also been developed.

Hydrolimax lævis is representative of the *Limaces* in the change from a land-life to an aquatic existence and, like others, was primitively aquatic and still possesses undoubted evidences of the former presence of the osphradium and ctenidium within the lung-chamber.

H. lævis now lives normally amidst wet surroundings and does not appear to be in the least incommoded by immersion in water, and when thus submerged is apparently undisturbed and has been found resting quite immobile and content for hours together beneath logs, etc., quite shut off from access to the free air.

Its favourite resting places are amongst the dense tufts of *Marchantia polymorpha*, *Sphagnum*, *Hypnum cuspidatum* and other similar situations.

The *Succineæ* were primitively aquatic species, but are now living a terrestrial life and are air breathers on their way to resume an aquatic life, having entered upon the early stages of the necessary changes to be accomplished. Their impulse is shown by the preference they so strongly exhibit for marshy grounds, canal and



Fig. 77



Fig. 78



Fig. 79

FIG. 77—*Succinea putris* (L.), with shell removed to show the lung, the kidney, the heart, etc. (after a sketch by Mr. Charles Ashford).

h heart; i. intestinal canal; p. pulmonary plexus or lung; r. renal organ or kidney.

FIG. 78—*Succinea putris* (L.) $\times 8$, showing the peculiar constriction of the oesophagus, the buccal retractors and salivary ducts by the shortening of the cerebro-visceral connectives.

FIG. 79—*Succinea putris* (L.), Ashley Marsh, Bristol, Miss F. M. Hele; to show the obesity of the tentacles and the general aspect.

river margins, as well as by the shrinkage of the Pedal-gland, an organ very important for land snails, but less so to aquatic species. The lower tentacles are also very short, as is said to be usually the case with snails frequenting a marshy habitat; the moist conditions under which they now prefer to live is shown by the albuminous capsules amongst which the ova are deposited, exactly as in the *Limnæidæ*.

This genus still retains some vestiges of the Primary Shell which for a period is enclosed in the pallial sac, this enveloping membrane is eventually ruptured and the relict form is freed and becomes the apex of the present day secondary shell.

Succinea elegans, which is the most aquatic in habit of our species, and the leader in the movement for the assumption of a watery habitat, is not inconvenienced by total and prolonged immersion.

The group have several distinct peculiarities of structure which mark them off from the other groups, they are recorded as world-wide in distribution, but it is very probable that in some cases this is due to "lumping" together shells which are passing through a similar stage of shell-degeneration, and thus acquiring a superficial external resemblance.

S. oblonga would appear to be varying in opposite direction, one section frequenting wet places, and even brackish water, as at Meathop Marsh, while another group is found living under stones and on the top of dry boundary walls, etc., on Meathop Fell, Grange, Westmorland.

I have placed before you the indications of some of the more salient features of "Mutations" or changes amongst our Native Mollusca, which they are now undergoing or have undergone, and in a measure have restricted myself to the "Mutations" of the shell and the habits of life they have followed, and have not dwelt upon the marvellous changes undergone or still in progress by every organ and faculty of the body, which have been dwelt upon at various times by myself and others.

In Progressive Evolutionary history the modifications may indicate and result in a distinct advance in status as in *Arion ater* and other species, which according to our embryologists were at one time Operculate Streptoneurous Mollusks, with an external, spirally coiled protective shell, whereas they are now Euthyneurous, and amongst the most advanced of their class.

In Retrogressive Evolution, the indolent and sedentary species are the less successful forms and tend to become more and more restricted in their modes of life but may by force of circumstances

take up a more or less subterranean existence or adopt an arboreal or even a parasitic life or may, if a land species re-assume an aquatic existence, all of which changes tend to degeneration.

Not only the shell, but the animal inhabitant is subject to cycles of change or rhythm of "Mutation" and every organ separately or in conjunction with other organs, or parts thereof, undergo great changes, whose phases are responses to the influence of the forces of the organic and inorganic environment and may extend over vast periods of time.

What is so impressive in these "Mutations" is the unhasting deliberation and persistency of the changes that are in process. Hundreds and thousands of years may elapse and still the movements continue their slow but irresistible progress. Figures of Mollusks made centuries ago, show little or no perceptible divergence from the mollusks of the present day, so that it may be that many centuries may elapse before change become apparent. These changes or transfers of the centres of specific stability move so excessively slowly as to be almost imperceptible, even after the lapse of ages.

The ancestral progenitors of our native mollusk, if still existent, are now probably isolated in inhospitable areas, or inhabit regions or islands remote from Europe. Possibly the kinship of the most primitive species with our modern representatives, may be revealed or suggested by a comparative study of the structure and embryology of the ancient forms and their Evolutionary history unfolded, a knowledge of which would probably tend to confirm the truth of the principles of "Dominancy" and also the accuracy of the suggested migratory routes by which the world-wide dispersion of the Mollusca has been attained.



Odostomia dipsycha, an example of Heterostrophy,
a term expressive of the irregular manner in which the vestigial shell
is made use of by this species.

TWO FOSSIL SPECIES OF LEPTACHATINA FROM THE ISLAND OF KAUAI.

BY PROF. T. D. A. COCKERELL.

(Read before the Society, November 3rd, 1926).

The two species now described were found by myself fossil in Haena sand-hills, on the Island of Kauai, Hawaiian Is. They are briefly referred to in "Nautilus," Jan. 1925, p. 83. The deposits are apparently of Pleistocene age. I have placed the type specimens in the Bishop Museum at Honolulu, where they can be compared with Dr. Cooke's incomparable series.

Leptachatina deceptor n. sp.

Shell thick, imperforate, conoidal, robust, finely longitudinally striate, with flattened upper whorls; apex obtuse, aperture rather broad, lip thickened, a well developed oblique lamella on columella, but well inside the aperture, so that it is not or hardly visible from the front; columellar margin bulging in middle; suture not impressed; outer margin of lip regularly convex. Whorls 6. Long. 8.2, lat. 4.2 mm., length of aperture 3.6 mm. Allied to *L. brevicula* Pease, but is more fusiform, with concealed columellar lamella.

Leptachatina haenensis n. sp.

Shell rather thick, imperforate, subconoidal, with shining surface, finely longitudinally striate, the striæ strongly curved below the suture; apex blunt; suture little impressed, lip somewhat thickened; a large oblique columellar lamella, conspicuously visible in front view. Whorls $6\frac{3}{4}$. Outer margin of lip evenly convex. Long. 8.6, lat. 4, length of aperture 3.4 mm. Broader and less cylindrical than Pease's figure of *L. antiqua*, with more convex outer lip. The shell is narrower and proportionately longer than in *L. deceptor*.

Limnæa pereger m. *sinistrorsum* planted near Stafford.—For the last three years I have planted out in two ponds near the Castle at Stafford sinistral examples of *L. pereger* in the hopes of their forming colonies. I have never seen one again, but I think it necessary to note the fact of my having planted them in case of someone discovering survivors at some future time.—LIONEL E. ADAMS (Read before the Society, Dec. 1st, 1926).

VARIATION IN *TRICHIA LIBERTA* (Westerlund).

By A. E. ELLIS.

(Read before the Society, January 5th, 1927).

Although a satisfactory anatomical comparison of *Trichia liberta* (West.) with *T. hispida* (Linn.) has not yet been made, the authority of Messrs. Kennard and Woodward, who give *T. liberta* specific rank in their List (1914), their Synonymy (1926), and various geological papers, warrants the separate consideration of the varieties of the two forms. The conchological differences between *T. liberta* and typical English specimens of *T. hispida* are well marked and not dependent upon environment. The largest specimen of *T. liberta* I have is from a damp osier bed, and the smallest from the dry banks of an ironstone quarry, woodland examples being intermediate in size, but all show equally well the characteristic features, namely globose shape, extremely narrow umbilicus, which is partly overlapped by the slightly reflected columellar lip, and the feebly developed apertural rib, as compared with the strong, white internal rib of *T. hispida*. According to Mr. Kennard, these distinctive features are also constant in fossil shells, even when occurring together as in the Pleistocene of Barnwell, and moreover the fossils of *T. hispida* are always white, while those of *T. liberta* are reddish brown, and intermediates are not found.

There are amongst my specimens of *T. liberta* two colour forms, which I have found in parts of Leicestershire and Northamptonshire usually living together in approximately equal numbers. In one, which I regard as the typical form, the shell is of a lightish brown horn-colour, and in the other, for which I suggest the varietal name *fusca*, it is of a deeper, reddish brown. The difference is more noticeable when the snails are alive, as the mantle of var. *fusca* is considerably darker than that of the paler shelled form. A large proportion of the shells of both colours has a whitish peripheral band, and for this variety I propose the name *albocincta*. This variation, which also occurs in other species of *Trichia*, in *Hygromia*, in *Theba*, and in *Cepæa*, and is said by Taylor to be atavistic, seems to be commoner in *T. liberta* than in *T. hispida*.

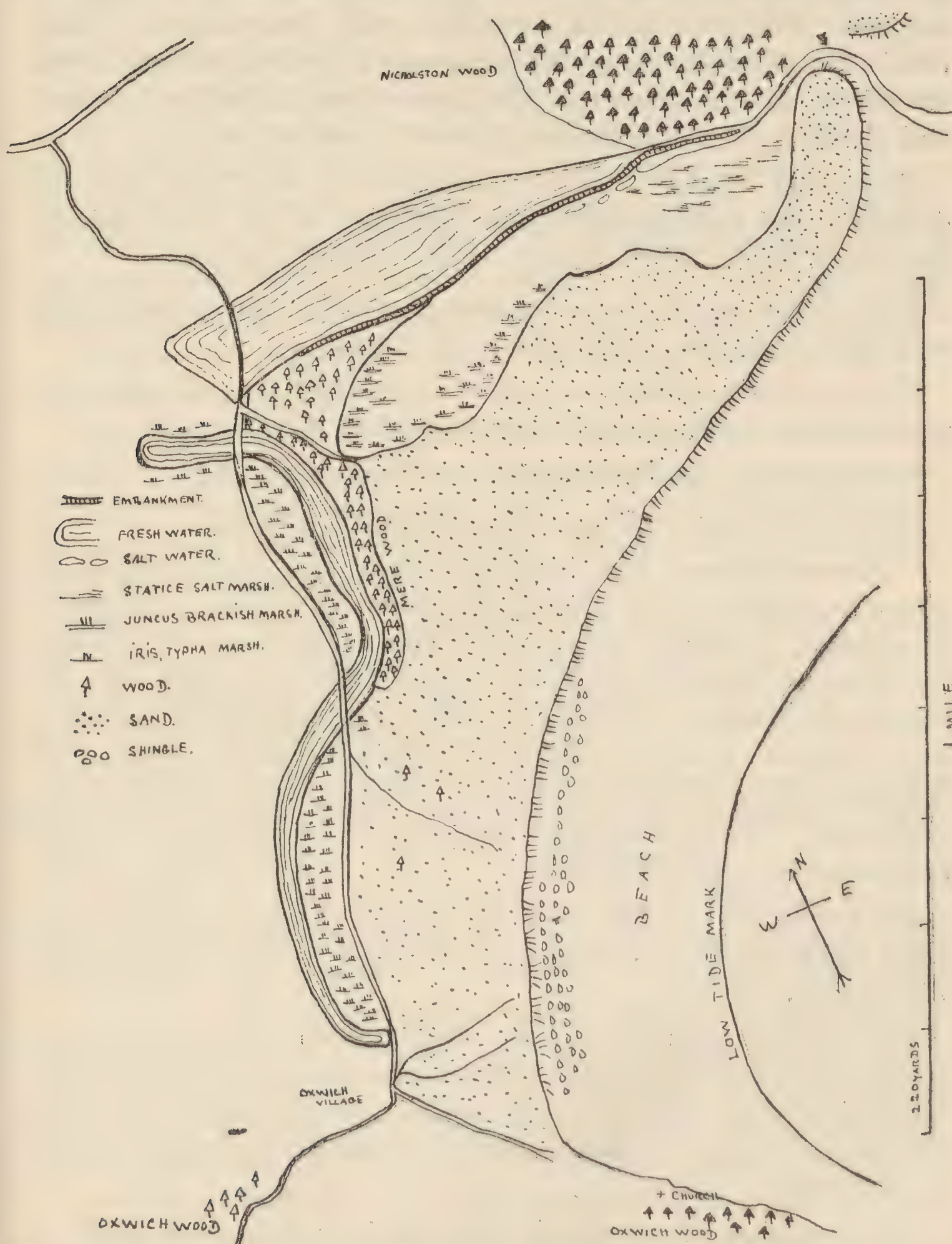
Specimens of these varieties have been deposited in the Society's collection. I have to thank Mr. A. S. Kennard for kindly authenticating my specimens of *T. liberta*, and answering queries on the subject.

OECOLOGICAL NOTES ON THE OXWICH SAND DUNE AREA

BY CAPT. H. E. QUICK.

(Read before the Society, November 4th, 1925).

OXWICH DUNES lie eleven miles west of Swansea on the south coast of the Gower peninsula. They run roughly north-east and south-west from Nicholston Wood to Oxwich Village (see sketch map).



The vegetation consists of marram grass on the dune summits, and areas of bracken and bramble on the slopes and in drier hollows,

with *Festuca ovina* and *myurus*, Hound's tongue, Spurge, Sea-holly, *Geranium molle*, etc. The damper hollows support a coating of algæ and moss with *Samolus*, *Chlora*, *Centaurea erythraea*, *Carex arenaria* and *Juncus maritimus*, with *Sedum acre* in the drier parts.

The northern freshwater mere is drained by a stream flowing at the foot of Nicholston Wood and is separated by an embankment from a salt marshy area that lies between it and the dunes. This marshy area is overflowed by spring tides, and driftwood is left all along its margins. The lower end supports *Salicornia*, *Beta maritima*, *Glaux*, *Statice limonium*, *Juncus articulatus*, *acutus* and *maritimus* and *Scirpus maritimus*, and the upper end *Juncus maritimus* and *acutus*, *Armeria* and *Arundo*. Teasel is conspicuous on the embankment.

Nicholston Wood is on a limestone cliff with Oak and Ash dominant, and contains also Elder, Sycamore, White Beam, Spindle, Hawthorn, Holly, Privet, Cornel, Hazel, Ivy and Juniper.

Mere Wood on the besanded area is poor in tree species, having only Wych-elm, Oak, Alder, Elder and Poplar.

There are three isolated clumps of six or eight trees of Oak, Alder and Elder on the dunes to the south of Mere Wood.

Oxwich Wood, like Nicholston, is on limestone cliffs.

The list of species for Mere Wood and its borders is:—

Limax arborum, *Agriolimax agrestis*, *A. lævis*, *Vitрина pellucida*, *Vitreola crystallina*, *Polita lucida*, *P. cellaria*, *P. alliaria*, *P. helvetica*, *P. nitidula*, *Euconulus fulvus*, *Arion ater*, *A. subfuscus*, *A. minimus*, *A. hortensis*, *Punctum pygmæum*, *Pyramidula rotundata*, *Helicella virgata*, *H. caperata*, *Ashfordia granulata*, *Hygromia hispida*, *Acanthinula aculeata*, *Vallonia costata*, *V. pulchella*, *Helix aspersa*, *H. nemoralis*, *Ena obscura*, *Cochlicopa lubrica*, *Pupa muscorum*, *P. umbilicata*, *Vertigo antivertigo* (scarce), *Balea perversa*, *Clausilia bidentata*, *Carychium minimum*.

On the borders of this wood *H. virgata* commonly assumes the form *nigrescens*, and *C. lubrica*, *P. muscorum* and *P. umbilicata* the form *albina*.

The isolated tree clumps on the dunes contain, with the commoner species, *Balea perversa* and *Acanthinula aculeata*, suggesting that Mere Wood once extended as far as this and that they are surviving islands of the partially besanded wood rather than seedling invaders of the dunes.

This invasion of woodland by sand is well seen in parts of Nicholston Wood north of the map where trees, still living, are half-buried in sand.

Nicholston Wood gives, in addition to most and probably all of the Mere Wood shells, *Clausilia laminata* and *Pomatias elegans*. Oxwich Wood also has these two species and *Acicula lineata*. The cliff below the church is probably the site of origin of specimens of *Cæcilioides acicula* found in shell pockets on the dunes. *Pomatias elegans* has been reported on sand dunes (Boycott, P.M.S., xiv., p. 128) but does not occur so here.

The meres are connected by a narrow channel of running water where the road crosses them. In the north mere *Paludestrina jenkinsi*, which occurs in both, extends down to the point where the mere first reaches Nicholston Wood but not lower down the stream towards the beach, while the brackish backwater and pools on the south of the embankment contain *Pal. ulvæ* and *Scrobicularia piperata*. *Phytia myosotis* occurs (*a*) under driftwood and fragments of cork and bark left by spring tides along the foot of the embankment and margins of the *Statice* marsh, and (*b*) in fissures and sun-cracks of the bare muddy banks of the stream lower down. Newly hatched young are abundant in August. *Pal. ulvæ* remains dormant in similar cracks when drought and neap tides coincide.

The upper and fresher portion of this marsh which is nevertheless overflowed by spring tides regularly contains living *Agriolimax lævis*, *Pupa muscorum* and *Vertigo antivertigo* abundantly, *Clausilia bidentata* less so, and *H. nemoralis* sporadically. Repeated search has failed to find *V. pygmæa* or *angustior* living on this site.

South of the isolated tree clumps on the dunes, however, *Vertigo pygmæa* occurs, accompanied by *Punctum pygmæum*, on the margins of clear, moist areas surrounded by bracken. It is found on the under-surface of fallen and decayed fronds.

The shingle beach is partially consolidated and supports a few Elder bushes, Bramble, Geranium and *Euphorbia paralias*. *Pyramidula ruprestris* is abundant under the loose stones.

The meres are not rich in species. The list consists of *Limnæa peregra* and *truncatula*, *Planorbis albus*, *Spirorbis umbilicatus* and *nautilus*, *Paludestrina jenkinsi*, *Anodonta anatina* and some *Pisidia*.

The dunes contain innumerable dead shells of *H. barbara*, but repeated search at all periods of the year has failed to find a living specimen. This species lives close to Swansea on a small area of a few square yards at Mumbles Road with *H. pisana*, which is supposed to have been introduced by Gwyn Jeffreys (see B.C., I., p. 208); and also at Port Eynon two and a half miles south-west, but not elsewhere on the Gower coast as far as I know. I can suggest no reason for its extinction at Oxwich, where it must once have been abundant over a wide area.

I have found one much-worn shell of *H. itala* on the dunes, but no living ones. It lives on a small area of Pennard Golf Links, two miles north-east, and this shell might have been carried by sea and wind to this point. It also lives at Llanmadoc on the north coast of Gower. As *itala* often occupies only a limited area compared with *virgata*, *caperata* and *barbara* as at Tenby, for instance, it is easier to understand its local extinction by besanding or otherwise.

Another species that occurs sparsely in shell pockets of the dunes is *Vertigo angustior*. This is so small that failure to find it living hitherto is not very conclusive. The fact that *angustior* and *barbara* look remarkably fresh and little worn points to a comparatively recent extinction.

The varied types of habitat within a space of about half-a-square mile, and the number of species, viz.: 38 living land mollusca (the 34 species given for Mere Wood, plus *laminata*, *elegans*, *acicula* and *lineata*) and 3 holocene, with several freshwater and brackish forms make this one of the most interesting areas in the Gower peninsula.

Food of *Limax flavus* L.—On the night of September 4th, 1925, a decapitated sparrow was found under an area grid in my cellar, having been dropped in all probability by some unfortunate feline. On inspection, a specimen of *Limax flavus* and two spiders were seen to be feeding on the body. On the night of the 5th, there were two slugs, on the 6th, two slugs at the body and one about six inches away. On the 7th, two on the body, 8th one on the body and one eighteen inches away, 9th two on the body, and one fifteen inches away, 10th, two on the body, one ten inches away and one eight inches away. That night the four slugs and sparrow's body were burned as I went away on holiday next day. From the last week in September, to October 5th, slugs were seen occasionally, but during a spell of cold weather were not in evidence. On the 16th and onward, slugs were again seen, this time eating crusts of bread which had fallen down the grid. This continued at intervals throughout the winter of 1925-26, until June, 1926, when they appear to have left the cellar grid, and traces of them were seen in the adjoining yard above where they were seen several times partaking of milk from saucers placed for the cats. They apparently seek the shelter of the cellar in the winter months, and during the summer take shelter in the walls of the yard.—C. H. MOORE (Read before the Society, August 28th, 1926).

ADDITIONAL NOTES ON THE LAND AND FRESHWATER MOLLUSCA OF SUSSEX.

BY MAUD AND GORDON DALGLIESH.

(Read before the Society, April 4th, 1925).

FOR the third year in succession, during May, 1924, we paid a brief visit to Henfield in West Sussex, and nearly all the time was spent in shell collecting. Henfield is a village of some considerable size situated on a hill above the river Adur looking towards the South Downs. Being away from the chalk, land mollusca are few in species, the soil being sandy, and though trees are plentiful there are no woods of any extent. The commonest trees are the Oak, Elm and Lime. There are no Beech woods and consequently *Marpessa laminata*, which is abundant only a few miles off, is absent. Low-lying meadows and marshes form the chief feature. The ponds and numerous streams gave good results. A large marsh, the breeding quarters of the snipe and redshank and the daily haunt of the heron, almost covered by water in the winter, is intersected by numerous ditches. These are almost choked by a rank growth of *Equisetum* and *Elodea canadensis*, while in places the surface of the water is covered with the beautiful Water Violet, *Hottonia palustris* and the Frog-bit, *Hydrocharis morsus-ranæ*. On account of this luxuriant growth of vegetation covering the water, it is difficult to use the scoop with any satisfaction, so possibly many shells were overlooked.

Polita lucida Drap. Turned up quite plentifully in a garden in Elm Grove, Brighton (P. Arnold). It was possibly introduced with plants.

Zonitoides nitidus, Müll. Found sparingly at Henfield under piles of cut and dried rushes in a marsh; also among dried leaves at the foot of an Oak-tree growing on the bank of a ditch. One found inside the empty shell of *Planorbis corneus*. Mr. P. Arnold informs us he has taken it near Lewes in the scoop, right under water.

Helicella virgata var. **nigrescens** Grat. One dead specimen taken near Brighton by Mr. H. S. Toms.

Helicella itala var. **minor** Moq-Tan. Bevendean, near Brighton (W. Law).

Helicigona arbustorum Linn. Storrington, Cray Lane, Pulborough; between Pulborough Church and Old Place. (R.G. Rice).

Helix pomatia Linn. In our former paper (vide *Journ. of Conch.*, vol. xvii., p. 180) we reported a dead shell found by Mr. P. Arnold at Shoreham. This we have since learnt is not the

place in Sussex, but Shoreham in Kent. A living specimen was found by W. Walton in his allotment garden at Kemp Town and brought into the Brighton Museum for identification in Sept., 1924.

Helix hortensis, Müll. With reference to our former note on this species not being found on the Downs, Mr. H. Beeston wrote to us as follows:—"I essayed to explore Chanctonbury Hill and Ring and to my astonishment found a variety of *hortensis* I had never seen before right on the top of the hill, on the Downs." The finding of this species on Chanctonbury is not sufficient evidence for maintaining that it is a Downland species. The wooded areas at the base and on the northern escarpment of Chanctonbury form an ideal habitat for *hortensis*, and this close proximity of such a habitat renders the occurrence of *hortensis* within Chanctonbury of little value as a test case for the snail's residence high upon the Downs. Henfield specimens are on an average smaller than those collected on the chalk. The shells too are more fragile and transparent. Average measurements of these gave alt. 15mm., length 24mm.; as against an average of alt. 16mm., length 25mm., from specimens collected on the chalk in East Sussex. The greater number seen during May, 1924 was immature, whereas the year before at the same time all or nearly all were mature. All plants during 1924 pointed to a backward season, and it seemed to be so with mollusca. *Helix nemoralis* in the Beech woods of East Sussex were quite a month or more behindhand in making their annual ascent of the trees. The following varieties were taken:—

Var. **minor** Moq-Tan. Taken by us at Henfield for the first time. This small form only measured alt. 14 mm., length 16 mm. That it was fully adult was proved by the well-formed lip.

Var. **lilacina** Taylor. We found this beautiful variety again this year (May, 1924) in fair numbers, though nearly all were immature. It is a pity that the colour is to a certain extent evanescent. Those collected the previous year, though shut up in a drawer, have lost a little of their former beauty.

Var. **arenicola** Macg. Two exceptionally fine specimens taken at Henfield.

Var. **roseozonata** Cockerell. One specimen taken at Henfield can be referred to this form.

Ena montana Drap. Miscombe Hangar, Ditcham, near Buriton. (H. Beeston).

Succinea pfeifferi Rssm. Very common on the rushes bordering ditches on the marsh at Henfield. Some were taken in the scoop from under the water.

Carychium minimum Müll. Found by us for the first time at Henfield in May, 1924. The examples collected were on the underside of a board lying beside a ditch on the marsh.

Marpessa laminata Mont. var. **pellucida** Jeff. and var. **albina** Moq. Chanctonbury Ring, Houghton Forest. "Here it is very abundant, commoner than the type; Bignor Hill, Stoke Down" (H. Beeston *in lit.*). One form that can only be referred to the var. *pellucida*, taken at Poynings is unusual in colouration and difficult to describe, but might almost be said to be pale salmon-pink.

Paludestrina ulvæ Penn. Should read "River Cuckmere, near Lewes," in *Journ. of Conch.* xvii., 182.

Sphærium lacustre Müll. Abundant in a small stagnant pond at Henfield. These were of a very fine colour and might be described as almost bluish. They were much smaller than the specimens taken in the brooks at Bramber, only a few miles distant and measured in breadth 9 mm., whereas the ones taken in running water gave 12 mm. When placed in a glass of water they were quite active, swimming to the surface.

Pisidium obtusale Pfeiffer. All *Pisidium* collected during 1924 appear to be referable to this species. We took it in ponds and running water. It is an abundant species in Sussex and we have taken it at Bramber, Henfield, Lewes and Midhurst.

Pisidium personatum Malm. Specimens received from Mr. R. Winckworth and collected at Chichester.

Notes on a colony of *Helicella virgata* da Costa—On a steep ridge, the most northerly of the Speeton Red Chalk just where it gives place to the Speeton clay there is, or was a colony of *Helicella virgata* of large size and uniformly conoid form. First found by the writer in 1916. Very few only then living: it has been visited on four or five occasions since, but only dead specimens have been found. The live shells, all variety *albicans*, when found were stained with the red chalk as were most of the dead ones. Average measurements alt. 11 m.m., B. 13 m.m. Associated with the *H. virgata* a colony of *Helicella itala* of normal though small form seems to have shared the same fate, as only dead shells could be found this year. These also when living were stained red with the chalk.—W. GYNGELL. (*Read before the Society, November 3rd, 1926*).

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND.

551st Meeting, held at the Manchester Museum, December 1st, 1926.
Mr. G. C. Spence in the chair.

Donations to Collections.

Framed portraits of H. and A. Adams, presented by Lionel E. Adams (their nephew).

Collection of autographs and a number of portraits of conchologists, presented by H. Schlesch.

Series of eroded *Limnæa stagnalis* from a pond near Stafford, from L. E. Adams.

Candidate Proposed for Membership.

Guy Lawrence Wilkins, 6, Abbott's Park Road, Leyton, London, E. 10 (introduced by J. C. Dacie, W. J. Wintle, and A. S. Kennard).

Papers Read.

"*Limnæa pereger* m. *sinistrorsum* planted near Stafford," by L. E. Adams, B.A.

"Erosion of epidermis due to absence of carbonate of lime," by L. E. Adams, B.A.

"*Helix nemoralis* var. *rubella-fasciata* and var. *rubella-fasciata* 00300 in Staffordshire," by J. W. Taylor, M.Sc.

"*Helicigona arbustorum* vars. *supra-fasciata* and *trifasciata* in Staffordshire," by J. W. Taylor, M.Sc.

Exhibits.

By Mr. A. K. Lawson:—*Helix nemoralis* and *H. hortensis* (including var. *arenicola*) from Ventnor; *H. aspersa* var. from Llandudno.

By Mr. C. H. Moore:—*Vermetus lumbricalis*; also *H. arbustorum* (extremes in size) from Pocklington, Yorks.

By Mrs. Gill:—Large series of *Oliva porphyria*.

The Special Exhibit was *Physa*.

552nd Meeting, held at the Manchester Museum, January 5th, 1927.

Mr. G. C. Spence in the chair.

Donations to Collections.

Series of *Trichia liberta* (Westerlund) from Northants, from A. E. Ellis.

Buccinum grænlandicum Chem., *Littorina palliata* Say (= *arctica* Möll.), *L. rudis* v. *grænlandica* Menke and *Limnæa* (*Galba*) *vahli* Möll., all from West Greenland, and presented by Hans. Schlesch.

New Member Elected.

Guy Lawrence Wilkins.

Candidates Proposed for Membership.

Dr. Fred Baker, Point Loma, California, U.S.A. (introduced by J. R. le B. Tomlin and J. W. Jackson).

William Ritson, Jr., 3, Arnold Street, Manchester Road, Warrington (introduced by J. W. Jackson and G. C. Spence).

Members Resigned.

Giles Owen. Rev. E. G. Alderson. W. F. Clapp.

Members Struck off the List.

Two Members were struck off in accordance with Rule iv.

Paper Read.

"Variation in *Trichia liberta* (Westerlund)," by A. E. Ellis.

Exhibits.

By Mr. A. E. Ellis:—Specimens to illustrate his note.

By Mrs. Gill:—Smaller forms of *Oliva*.

The Special Exhibit was *Diplommatina*.

553rd Meeting, held at the Manchester Museum, February 2nd, 1927.

Mr. G. C. Spence in the chair.

New Members Elected.

Dr. Fred Baker. William Ritson, Jr.

Candidate Proposed for Membership.

George W. Young, F.G.S., 20, Grange Road, Barnes, Surrey (introduced by J. C. Dacie and J. E. Cooper).

Papers Read.

"Additional Notes on the Mollusca of the Oxford District," by A. E. Ellis.

"Fossil Marine Shells by the Roadside on the Yorkshire Coast," by C. H. Moore.

Exhibits.

By Mr. C. H. Moore:—Shells to illustrate his note; also specimens showing peculiarities of growth or colour.

By Mr. A. K. Lawson:—Large fossil oyster, *Exogyra sinuata*, from the Lower Greensand, Shanklin, I.W.

By Mr. G. C. Spence:—Large series of *Limicolaria*.

The Special Exhibit was *Cerion*.

Fossil Marine Shells by the Roadside.—In the autumn of 1924, whilst walking along the high road between Hinderwell and Staithes, two villages on the Yorkshire coast, a portion of the road was being widened, and in the bank at one side a vertical section of the upper stratum was exposed for a depth of about three or four feet. Though almost a mile from the present coast-line, which is being rapidly eaten away by the action of the waves, several marine shells were to be seen. The surface of the road would be about eighty feet above sea-level. The most numerous species were *Patella vulgata*, *Mytilus edulis* and *Littorina littorea*. The matrix was composed of sandy gravel.—C. H. MOORE (*Read before the Society, February 2nd, 1927*).

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VOL. 18.

JUNE, 1927.

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LIST OF MEMBERS.

The following CHANGES OF ADDRESS, etc., should be noted:—

- Adams, Lionel E., B.A., Violet Bank, Shide Road, Newport, I.W.
 Blackburn, Rev. E. Percy, 9, Stanley Street, Blyth, Northumberland.
 Bliss, Joseph, M.P., etc., 41, Buckingham Palace Mansions, Grosvenor Gardens, London, S.W. 1.
 Cave, Mrs. A. J. E., (née Dimbleby), Cashel, Brownberrie Avenue, Horsforth, near Leeds.
 Dalgliesh, J. G., F.L.S., 50, Tisbury Road, Hove.
 Davies, W. H., St. Fillans, Beechfield Avenue, Forsyth Road, Flixton, near Manchester.
 Dyke, F. M., B.Sc. (Lond.), "Branksome," Boreham Wood, Elstree, Herts.
 Ellis, A. E., Lancing College, Shoreham, Sussex.
 Frames, P. R., "Silverhurst," Alexandra Road, Wynberg, S. Africa.
 Garnett, Roland, 1, Grosvenor Road, Banbury.
 Hawkins, Prof. H. L., The University, Reading.
 Lindsay, The Hon. Lionel, M.C., B.Sc., F.Z.S., Hambrook House, Chichester.
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 Nevill, Rev. R. W., M.A., Old Cotton Vicarage, Norwich.
 Preston, H. B., F.Z.S., c/o Westminster Bank, 25, Sussex Place, London, S.W. 7.
 Robertson, Miss J. D., 41, Meadway Court, Hampstead Garden Suburb, London, N.W. 11.
 Sich, Alfred, F.E.S., "Grayingham," Farncombe Road, Worthing, Sussex.
 Simpson, James, 242, Union Street, Aberdeen.
 Wincott, A. W., Ardenne, Speer Road, Thames Ditton, Surrey.
 Woods, Henry, M.A., F.R.S., F.G.S., Sedgwick Museum, Cambridge.
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New Members, Resignations, Deaths, etc. will be found in the Proceedings, pp. 55-6, 79-84, 126-7.

Erosion of epidermis due to absence of Carbonate of Lime.—In Mr. J. W. Jackson's interesting presidential address he shows how the erosion of *M. margaritifera* is caused by the dearth of calcium carbonate and the superabundance of carbonic acid. I had long ago noticed this erosion in waters destitute of lime, but erroneously supposed that it was caused by the snails eating each other's shells for the sake of the lime to form their own shells. I enclose examples for cabinet of an extreme case of this erosion in *L. stagnalis* from a pond near Stafford.—
 LIONEL E. ADAMS (*Read before the Society, December 1st, 1926*).

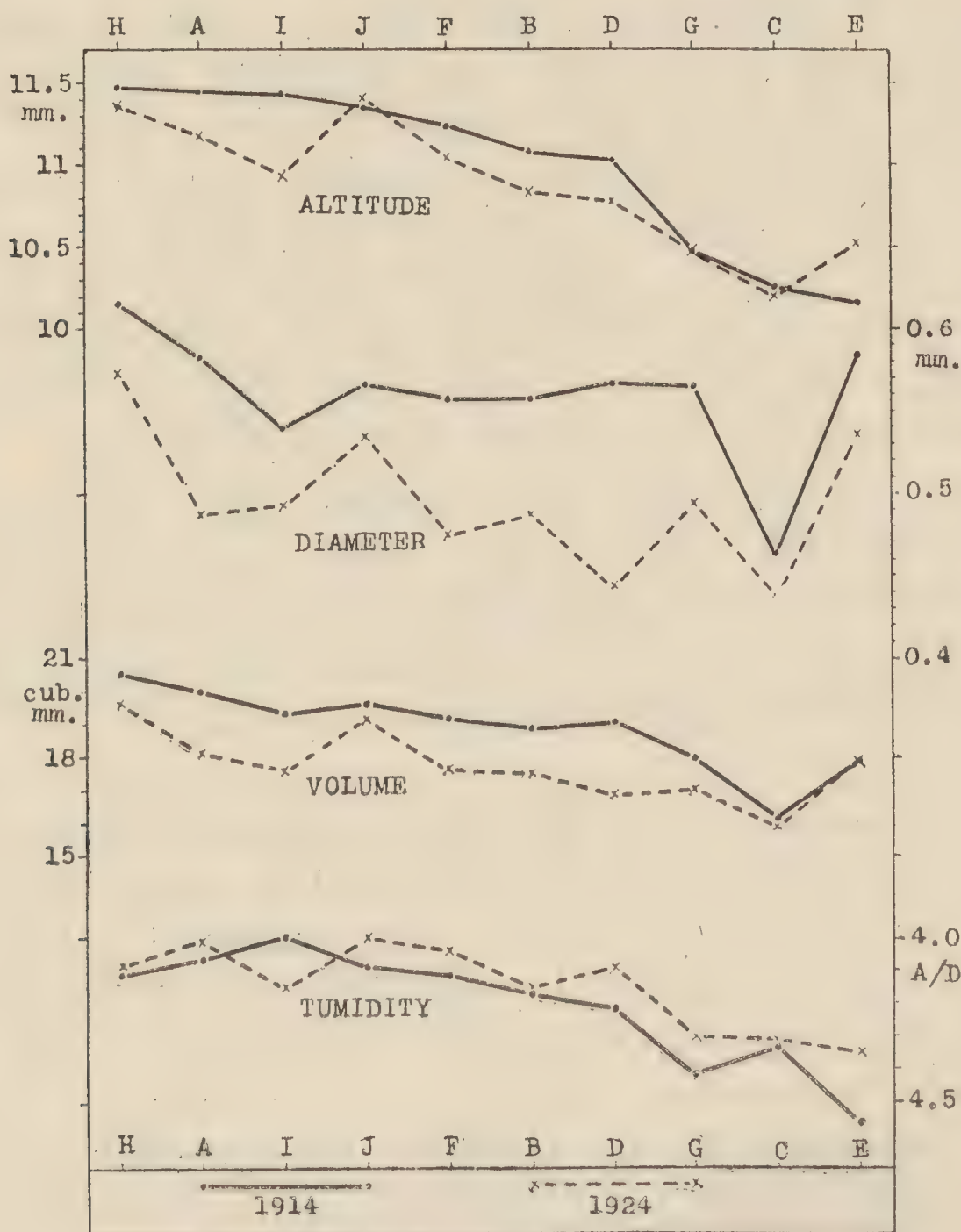
Sinistral *Hygromia hispida* in Herts.—Among a number of *H. hispida* that I washed out recently from shell-marl of Holocene age at King's Langley, Herts., was a damaged but perfectly recognisable example with spire reversed.—
 CHAS. OLDHAM (*Read before the Society, April 2nd, 1927*).

FURTHER OBSERVATIONS ON THE LOCAL VARIATION OF *CLAUSILIA BIDENTATA*.

By A. E. BOYCOTT.

(Read before the Society, January 6th, 1926).

In 1914 I collected *Clausilia bidentata* from ten restricted loci on stone walls in the neighbourhood of Portmadoc, Carnarvonshire, and showed (this *Journal*, vol. xvi, 1919, p. 10) that the shells from each locus differed in size from those from most of the other loci. It was, obviously, possible that this was a fortuitous and temporary result, and that there was no permanent association between the sizes and the loci. Accordingly ten years later I repeated the observation, and in September, 1924, collected a



further series of samples from the same places, measured them with the same gauge and analysed the results by the same statistical methods. In one respect the methods were improved by collecting, when possible, from each place in several batches so that the homogeneity of the whole sample might be tested and verified.

I have shown (*Proc. Malac. Soc. London*, vol. xiv (1920) p. 34) that *Cl. bidentata* can vary significantly within an area (beech wood) which is apparently roughly homogeneous, and in this kind of work it is desirable to make sure, as far as may be, that two or more loci are not being mixed together. In making the collections I had the invaluable help of Dr. E. J. Salisbury: the weather was all that could be desired, but without his aid it would have been impossible to secure the necessary material in the limited time available.

The world fortunately moves slowly round Portmadoc, and the loci seemed substantially unchanged¹ in character and surroundings. They are mortared stone walls (except I which is loose); A B C D and F are retaining walls, backed with earth; A B F H I and J border on high roads, C and D on little-used tracks; E and G are roofless buildings in woods. There is little but cryptogamic vegetation except at C where there is a good deal of *Asplenium trichomanes*; parts of G and J are ivy covered. *Limax arborum*, *Hyalinia alliaria*, *Pyramidula rotundata* and *Pupa umbilicata* occurred in all; *Zonitoides excavatus* in A B and C; *Hygromia rufescens* in D and G; *Hyalinia helvetica* in E and G; *Balea perversa*, which is not uncommon on the walls in the district, but never, as far as I have seen, along with *Cl. bidentata*, and *Pyramidula rupestris*, which is rare, were found in none.

Among themselves the 1924 samples differ even more than did those of 1914. Of the 45 possible comparisons (table II) 27 are statistically significantly different in both altitude and diameter, 9 in altitude only, 6 in diameter only, and only 3 (A/F, B/I, F/I) are indistinguishable, compared with 12, 18, 7 and 8 respectively in 1914.²

The comparison of 1914 with 1924 is summarized in table III. In **altitude** E shows an exceptional and J a negligible increase, the rest are all smaller than in 1914, though the difference is significant only in A B and I. The difference varies from + 3.4 per cent to - 5.2 per cent, on the whole - 1.2 per cent or

1 In 1914 locus E was represented by the inside of the walls of a house begun about 100 years ago and never finished, and a number of ash and sycamore trees growing inside. The snails were taken partly on the walls, but mostly on the trees. In 1924 most of the trees had been cut down and we got the *Clausilia* almost entirely off the walls. The area is quite small, and it seems unlikely that the change can have had much effect but it is worth noting in view of the considerable difference between the 1914 and 1924 samples.

2 This is partly due to the number of specimens from each locus not being the same in the two series. Though the total number examined in 1924 was about the same as in 1914 (2277 : 2198) the samples were more even, which makes the criteria of difference (which depend on the square root of the number examined) smaller. The absolute differences in altitude were actually smaller in 1924 by 24 per cent, those in diameter greater by 20 per cent.

excluding E, about which there is some doubt, — 1.7 per cent. The **diameter** is smaller in all and significantly smaller in all but C, the difference varying from — 4.8 to — 1.1, on the average — 2.5 per cent. Some of this diminution is a natural result of the decrease in altitude. But as far as the low and variable correlation between diameter and altitude in this species will allow us to calculate, the whole of it cannot be due to this and we conclude that the 1914 snails are essentially narrower. The average **tumidity** coefficient rises from 4.29 to 4.35, some increase being present in every sample except I, where the diminution in altitude has been proportionately greater than the diminution in diameter. The **volume**, calculated on the more or less erroneous assumption that the shell is a cone ($V = \pi (\frac{D}{2})^2 \times \frac{A}{3}$), is consequently smaller. There is no significant change in the **variability**.

But despite these differences, the relative positions of the different loci in the series remain substantially the same, as is best seen in the figure in which they are arranged in the descending order of the 1914 altitudes. The largest in 1914 remain generally the largest in 1924, and the correspondence of the conspicuously small samples is even more striking. The general fall in size has affected the small races less than the larger ones and C, from an exposed inhospitable locus, has remained the same through the ten years. Whatever the cause of the change it has evidently affected the whole district while leaving each locus with its characteristic *Clausilia* population.

It would have been interesting to consider the meteorological changes but I have been unable to obtain the necessary data from the interrupted records in the immediate neighbourhood; the local variation of rainfall in the district is so great that records from further afield do not apply. That 1923 was a most exceptionally wet year may be germane.

At the foot of table I are given the details of four other lots. (1) In 1914 A was injudiciously collected from both sides of a lane; most (603 of 712) were from the south wall, and comparison of the two walls showed no difference. In 1924 the A sample was taken entirely from the south wall and A* from the north wall. The latter proved different in diameter, and compared with the north wall sample of 1914 showed the same general diminution in altitude and diameter as the other loci. (2) In 1913 a series (K) collected from a wall at Beddgelert showed the remarkably low altitude variability of 5.1; this was not included in the published series owing to the small number of

specimens. A more ample sample got in 1924 had the same characteristic. In the same way an exceptionally high variability is reproduced in D (7.2 in 1914, 7.8 in 1924). (3). Two fresh Portmadoc loci (L and M) have been examined in 1924. The data are recorded in case someone has the interest to re-examine them in ten or twenty or a hundred years time, towards which end all the loci have been marked on a 6 in. map which is deposited in the Society's library.

SUMMARY

A re-examination of the altitude and diameter of *Clausilia bidentata* from ten loci in the neighbourhood of Portmadoc after ten years shows (1) that the shells differ from locus to locus as before, (2) that the characteristic size for each locus is, in general, maintained, (3) that the 1924 shells are generally narrower.

TABLE I.
1924.

Locus	Number examined	Altitude.													Diameter.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
		8.0	8.4	m.m.	8.5	8.9	m.m.	9.0	9.4	m.m.	9.5	9.9	m.m.	10.0	10.4	m.m.	10.5	10.9	m.m.	11.0	11.4	m.m.	11.5	11.9	m.m.	12.0	12.4	m.m.	12.5	12.9	m.m.	13.0	13.4	m.m.	13.5	13.9	m.m.	Maximum	m.m.	Minimum	m.m.	Mean	m.m.	Coefficient of variation.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
		2.2	m.m.	2.3	m.m.	2.4	m.m.	2.5	m.m.	2.6	m.m.	2.7	m.m.	2.8	m.m.	2.9	m.m.	Mean	m.m.	Coefficient of variation.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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TABLE II.

Summary of significant differences. + in altitude; o in diameter.

	A	B	C	D	E	F	G	H	I	J
A		+	+ o	+ o	+ o	—	+	+ o	+	+ o
B	+		+ o	o	+ o	+	+	+ o	—	+ o
C	+ o	+ o		+	+ o	+ o	+ o	+ o	+ o	+ o
D	+ o	o	+		o	o	+ o	+ o	o	+ o
E	+ o	+ o	+ o	o		+ o	o	+ o	+ o	+
F	—	+	+ o	o	+ o		+	+ o	—	+ o
G	+	+	+ o	+ o	o	+		+ o	+	+ o
H	+ o	+ o	+ o	+ o	+ o	+ o	+ o		+ o	o
I	+		+ o	o	+ o		+	+ o		+ o
J	+ o	+ o	+ o	+ o	+	+ o	+ o	o	+ o	

TABLE III.

Locus	Altitude m.m.					Diameter m.m.					Tumidity	
	1914	1924	diff.	diff. — P.E.	1924 if 1914 =1000	1914	1924	diff.	diff. — P.E.	1924 if 1914 =1000	Alt. — Diam.	1914 1924
A	11.436	11.181	-0.255	5.2	978	2.581	2.488	-0.093	14.4	964	4.43	4.49
B	11.091	10.827	-0.264	3.5	976	2.559	2.488	-0.071	6.2	972	4.33	4.35
C	10.241	10.200	-0.041	0.4	996	2.463	2.436	-0.027	2.2	989	4.16	4.19
D	11.024	10.781	-0.243	1.9	978	2.568	2.444	-0.124	9.7	952	4.29	4.41
E	10.171	10.519	+0.348	5.1	1034	2.584	2.536	-0.048	5.0	981	3.94	4.15
F	11.228	11.061	-0.167	1.7	985	2.559	2.475	-0.084	5.9	967	4.38	4.47
G	10.489	10.484	-0.005	0.1	1000	2.565	2.496	-0.069	7.0	976	4.09	4.20
H	11.473	11.373	-0.100	2.1	991	2.617	2.573	-0.044	6.3	983	4.38	4.42
I	11.429	10.834	-0.595	5.9	948	2.540	2.493	-0.047	3.8	981	4.50	4.35
J	11.348	11.406	+0.056	0.8	1005	2.566	2.534	-0.032	3.5	988	4.42	4.50
Mean	10.993	10.867			988	2.560	2.496			975	4.29	4.35

BRACHYPODELLA (GYRAXIS) EMERITA, n.sp.

By GEO. C. SPENCE.

(Read before the Society, March 2nd, 1927).

Shell dextral, fusiform, last whorl diminishing below, three immediately preceding whorls about the same diameter, above which it tapers regularly to the attenuated spire. Surface pale matt horn-coloured between raised crescent-shaped hollow whitish ribs which are regularly spaced on the earlier whorls but become very irregular later. These ribs are sometimes straight, sometimes well curved, and occasionally, particularly on the last whorl, the lower portion is bent round to the right along the suture, thus giving a sickle-like appearance. Ribs frequently broken down so that, being hollow, they appear as two fine light lines on the darker ground-colour.

Whorls, 17 in a complete shell (usually only 10/12 remain) well rounded on the upper and becoming flattened on the lower portion of the shell. Suture impressed. Last whorl rounded, descending at about 45° in a short round neck, encircled with 5 or 6 white ribs, to the mouth. Aperture rounded, obtusely angled above, with well expanded peristome which is slightly sinuous in profile. Axis slender, slightly twisted and becoming "corkscrewed" in the lower whorl, showing a "well" or false umbilicus visible in the aperture when viewed from below.



SIZE. Type—complete shell—12 × 2.5 mm. Specimen retaining 11 whorls 10 × 2.5 mm.

HABITAT. Cuba. Unfortunately no more exact locality can be given, this set being labelled "*Cylindrella*, Cuba, ex coll. Bouchard."

Type in my collection. Co-types in Natural History Museum, South Kensington, and Manchester Museum.

ADDITIONAL NOTES ON THE MOLLUSCA OF THE OXFORD DISTRICT.

By A. E. ELLIS.

(Read before the Society, February 2nd, 1927).

The following brief notes are supplementary to the Rev. L. W. Grensted's chapter on the "Land and Fresh-water Mollusca of the Oxford District," in "The Natural History of the Oxford District," edited by Comm. J. J. Walker (1926). All the following records refer to the years 1922 to 1924.

Testacella haliotidea. Common in the shrubbery in front of the University Museum in Parks Road, and in a garden at Old Headington.

Limax cinereoniger. Shirburn Wood.

Arion intermedius, for which Mr. Grensted states that "Blenheim Park is the nearest recorded locality," occurs in a meadow at Woodeaton (var. *normalis* Moq.), and in numerous woods near Oxford, including Bagley Wood. The other species I have noted in Bagley Wood are as follows: *Limax cinereoniger*, *L. marginatus* (= *arborum*), *Agriolimax agrestis*, *Arion ater* (with vars. *rufa*, *livida*, *marginata* and *plumbea*), *A. subfuscus*, *A. circumscriptus*, *A. hortensis*, *Vitrina pellucida*, *Oxychilus cellarius* var. *compacta*, *O. helveticus*, *O. alliarius*, *Retinella nitidula*, *R. pura*, *Cepæa nemoralis* var. *rubella*, *Goniodiscus rotundatus* (and var. *alba*), *Azeca goodalli*, *Cochlicopa lubrica*, *Arianta arbustorum*, *Carychium minimum*, *Clausilia rugosa*, *Marpessa laminata*, *Trichia hispida*, *T. striolata*, *Pomatias elegans*, *Euconulus fulvus*, *Vitrea crystallina*, *Acme lineata* (and var. *alba*), *Acanthinula aculeata* (this and the last amongst beech leaves), *Punctum pygmæum* and *Columella edentula*.

Retinella pura. Wootton Wood, Woodstock, May 1923, together with *Arion intermedius*, *A. subfuscus*, *A. ater*, *A. hortensis*, *Oxychilus cellarius*, *O. alliarius*, *Retinella nitidula*, *Vitrea crystallina*, *Vitrina pellucida*, *Carychium minimum* and *Marpessa laminata*.

Zonitoides nitidus. Near Weston-on-the-Green, together with *Succinea pfeifferi*, *Arion intermedius*, *Agriolimax lævis* and *A. agrestis*.

Agriolimax lævis. Bank of R. Evenlode, near Combe. In the river at this place occur *Limnæa pereger*, *L. stagnalis*, *Planorbis planorbis*, *P. contortus*, *Ancylus lacustris*, *Bithynia tentaculata* and *Theodoxus fluviatilis*.

Oxychilus helveticus. Common amongst ivy in Lyehill quarry, near Wheatley, and in ditches near Kirtlington amongst nettles.

O. draparnaldi. Occurs in the open in the Botanic Garden at Oxford.

Punctum pygmæum. Hen Wood, together with *Retinella pura*, *R. nitidula*, *R. radiatula*, *Oxychilus cellarius*, *O. helveticus*, *O. alliarius*, *Vitrea crystallina*, *Euconulus fulvus*, *Goniodiscus rotundatus*, *Carychium minimum*, *Arion subfuscus*, *A. hortensis*, *A. ater* (and vars. *rufa* and *plumbea*).

Helicella caperata. Specimens of large size occur at the edge of cornfields near Whiteoak Green, together with *H. gigaxii* and *H. virgata*, all of exceptionally large size. Very large specimens of the last two are found in cornfields by the Banbury road, near Thrup.

Balea perversa. In a wood near Studley, under fallen branches, and on an old wall by the Islip road, Woodeaton, with *Vertigo pusilla*, *Pyramidula rupestris*, *Vallonia costata* and *Lauria cylindracea*.

Marpessa laminata. Is found in several localities around Oxford, Ewelme and Howe Wood near Watlington being good places. The following species also occur in Howe Wood: *Arion intermedius*, *A. ater*, *A. circumscriptus*, *Limax maximus*, *Helix aspersa*, *Cepæa nemoralis*, *Trichia striolata*, *T. hispida*, *Helicigona laticosta*, *Ena montana*, *E. obscura*, *Pomatias elegans*, *Oxychilus cellarius*, *O. alliarius*, *Retinella nitidula*, *R. pura*, *Vitrea crystallina*, *Vitrina pellucida* and *Goniodiscus rotundatus*.

Azeca goodalli. Inhabits Headington Wick Copse. The following are also to be found in this locality: *Marpessa laminata*, *Clausilia rugosa*, *Pomatias elegans*, *Ena obscura* (this and the last species are common here, and live together amongst loose soil and dead leaves), *Cochlicopa lubrica*, *Oxychilus cellarius*, *O. alliarius*, *O. helveticus*, *Retinella pura*, *R. nitidula*, *Vitrina pellucida*, *Vitrea crystallina*, *Arion intermedius*, *A. circumscriptus*, *A. hortensis*, *A. ater*, *Agriolimax agrestis*, *Trichia hispida*, *T. striolata*, *Cepæa nemoralis*, *C. hortensis*, *Carychium minimum*, *Goniodiscus rotundatus*, *Euconulus fulvus*, and a few *Helicella caperata* at the edge of the copse, being intruders from the adjacent fields, where the species occurs in company with an abundance of *H. itala*.

Vertigo pygmæa. Is common in the river rejectamenta at Farmoor, together with large numbers of *Vallonia pulchella*.

Planorbis crista. On leaves of *Potamogeton natans* in a pond near Long Hanborough.

P. planorbis monstr. **scalariforme.** One dead shell in R. Thames at Wytham, May 1922.

P. acronicus. Dead shells in dredgings from R. Thames below Folly Bridge at Oxford.

AN ABNORMALITY IN *LIMNÆA STAGNALIS* (Linn.).

By A. E. ELLIS.

(Read before the Society, April 2nd, 1927).

In 1921 I found an empty shell of *Limnæa stagnalis* floating on the large pond at Wistow, near Leicester, which shows a curious abnormality. Just over $\frac{1}{2}$ -inch from the peristome, measuring along the suture, the upper margin of the body whorl, at the suture, curves outwards away from the preceding whorl and, forming an arch nearly $\frac{1}{16}$ -inch in height, rejoins the penultimate whorl $\frac{1}{9}$ -inch further on. The suture is then normal for $\frac{1}{16}$ -inch, and then another arch, $\frac{1}{8}$ -inch long, is formed. The margin of the body-whorl is again in contact with its predecessor in the normal manner for a further $\frac{1}{16}$ -inch, when a third and last arch is formed, $\frac{1}{6}$ -inch in length, and the last $\frac{1}{16}$ -inch of the suture is



normal. Although the suture is thus interrupted at three regular intervals, the holes so formed do not open into the interior of the shell, for a nacreous layer has been secreted some way within each of the miniature arches, so as to make them into little pockets bulging into the interior of the shell. The whole shell is $1\frac{3}{16}$ -inch in height. This abnormality may be due to the presence of some organism, such as the sessile Infusoria which were present on the shells of *Planorbis corneus* in the same pond, but no abnormalities were observed among these latter, which were plentiful and of fine growth. The pond contains an abundance of the moss *Fontinalis antipyretica*, on which were large numbers of *Bithynia tentaculata*, and the bottom is thickly strewn with dead leaves from the surrounding trees. I am indebted to my father for drawing the accompanying figure.



THE FRESH WATER MOLLUSCA OF SALE MEADOWS, CHESHIRE.

BY H. DE W. MARRIOTT.

(Read before the Society, January 6th, 1926).

SUBSEQUENT to a visit of general faunal and floral survey paid to this district in July last by Mr. Lawson and myself, we made a further examination on October 10th with a view to determining as far as possible the ecological standpoint of the Fresh Water Mollusca, consequent on the continuous flooding of this area.

We found that the small brook running through the meadows had recently been thoroughly cleared out and re-banked, and that literally tens of thousands of dead shells were to be seen amongst the mud and weed heaped at the sides. The few strands of weed (mainly *Hottonia palustris*) remaining in the water were covered with hungry snails, and naturally the conditions obtaining made it difficult to say whether the species enumerated are the only ones which occur there.

A careful search, however, of the mud and an hour's work with two scoops produced the following:—

<i>Planorbis</i>	<i>corneus</i> (Linné).
„	<i>carinatus</i> (Müller).
„	<i>spirorbis</i> (Müller).
<i>Limnæa</i>	<i>stagnalis</i> (Linné).
„	<i>peregra</i> (Müller).
<i>Physa</i>	<i>fontinalis</i> (Linné).
<i>Sphærium</i>	<i>corneum</i> (Linné).

The outstanding species was, of course, *P. corneus*, and nearly all the shells were badly stained with black mud or coated with a red deposit, the only clean ones being the very young specimens. The oldest shells were much eroded, full-grown *L. stagnalis* being mostly decollate and *P. corneus* deeply pitted, in many instances the pits having developed into holes right through the shell. It is hoped to pay a further visit next year.



THE HISTORY OF *HELIX HORTENSIS* AND *HELICELLA* *CAPERATA* AT ABERDEEN.

By A. E. BOYCOTT.

(Read before the Society, August 28th, 1926).

IN describing for the first time the variety of *Helix hortensis* with unpigmented bands and naming it var. *arenicola* William Macgillivray ("A history of the molluscous animals of the Counties of Aberdeen, Kincardine and Banff," London, 1843, p. 84) says "found by me, while with Dr. Fleming and Mr. Leslie, on the sand hillocks near Black Dog Farm, in the parish of Belhelvie. It is there abundant, and unmixed with any other variety." On July 9th, 1926, I had a chance of visiting Black Dog, which is about 5 miles north of Aberdeen, and it was very interesting to find that *hortensis* still occurred there as it was found by Macgillivray some 85 years ago. On the fixed dunes (which concretions of calcium carbonate in the blow-outs show to be highly calcareous) among marram grass growing in a carpet of *Lotus corniculatus*, *Thalictrum minus*, etc. Dr. Chick, my son and I soon collected 296 *arenicola* without finding a single specimen of any other variety, and it was not till we had travelled fully a mile southwards that we found the first example of the ordinary *lutea fasciata* form with brown bands. Over one area here we took a mixture of *lutea fasciata* (43), pale brown *fasciata* (17), and *arenicola* (10); *hortensis* then disappeared—our search was necessarily rather superficial—and when we found it again, less than a mile north of the Don and perhaps $2\frac{1}{2}$ miles south of Black Dog, we took only *lutea fasciata* (119 specimens): the unbanded *lutea* we did not see. Mr. C. Diver has been good enough to examine the shells critically.

Macgillivray unfortunately does not specify how near to Black Dog he found the other two forms he mentions—*lutea fasciata* and *lutea unicolor*—but he says of the species generally "very common in pastures along the coast, especially among the sand hills," and it is perhaps legitimate to assume that one or both of them occurred somewhere in the long line of sand hills of which the Black Dog dunes form a part. At any rate the colony of *arenicola* has remained pure for a long time; whether *lutea fasciata* have always been so near as we found them we do not know. Booth visited "the sand hills on Belhelvie golf-links, near the Black Dog Rock," in 1910 (*Scottish Naturalist*, 1913, p. 202) to verify Macgillivray's record, and reports that "here the species and the variety were found commonly as regards dead shells, but living ones were scarcer. The band formulæ

observed were *lutea* (12)3(45) and (123)45." But it is not clear what limits Booth was placing on the Black Dog locus; the place where we found *fasciata* might well come under his description.

Such pure colonies of any variety of *hortensis* are very uncommon: we should perhaps expect to find them towards the limits of their distribution. The var. *arenicola* occurs throughout England and Wales, from Cornwall and Kent to Durham and Westmorland, in Scotland Taylor (*Monograph*, vol. iii, p. 356) records it from North Berwick, where it is "very rare," H. Coates (*Trans. Perthshire Soc. Nat. Sc.*, vol. vii, 1922, p. 28 of reprint) from near Perth, and K. H. Jones and A. S. Kennard (*Proc. Malac. Soc. London*, vol. xiii, 1919, p. 151) from East Ross. The common forms in the north of Scotland are *lutea fasciata* and *unicolor*, the former apparently much the more frequent; *olivacea* is recorded from Aberdeen North, Sutherland and Ross; the other colour forms seem to be unknown. It seems likely that there are many places in this area where *fasciata* with pigmented bands occurs alone; this can be established only by careful *ad hoc* surveys. In eastern Canada only banded and unbanded *lutea* and *arenicola* are found.

Macgillivray (*op. cit.*, p. 84) could find *H. caperata* only near the brick-kilns at Old Aberdeen, and he especially notes in his "Natural History of Dee Side and Braemar" (1855, p. 419) that this is the only spot in which it was noticed in the neighbourhood. Booth (*loc. cit.*, p. 203) says "common on the sand hills in Belhelvie golf-links," and so I saw it in 1926, finding specimens immediately to the north of the Don. If it was anything like as common in Macgillivray's time he can hardly have failed to see it.



Habitats of *Trivia arctica* (Montg.) and *Trivia monacha* (da Costa).—It was noted that live specimens of the former were found in *Zostera* and of the latter on low water rocks. This was true in every case during our work in Cornwall in August and September, 1926. *Trivia monacha* was far more robust in structure. Both species were got from lobster-pots off Chideock, Dorset, in previous years.—ALAN GARDINER.

The submerged forest at Amroth, South Wales.—This is remarkable for the extraordinary numbers of the following species:—*Tellina fabula* and *squalida*, *Donax vittatus*, of which a fine yellow form occurs, *Gari ferroensis*, *Chamelaëa gallina*, *Thyasira flexuosa*, *Decipula ovata* and *Barnea candida*. I have one of the last from this locality $4\frac{3}{4}$ inches in length. Many of the leaves and twigs are in a good state of preservation and large stumps are exposed at some tides.—ALAN GARDINER.

DISAPPEARANCE OF *LITTORINA RUDIS* var. *TENEBROSA* Mont.

By J. C. DACIE.

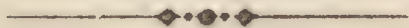
(Read before the Society, November 3rd, 1926).

IN July, 1906, I collected quantities of this variety at Walton-on-Naze, where they appeared to abound in the Mill Pond and its estuary. Visiting this locality in 1922 and again in 1923, I was surprised to find that it had disappeared and could discover no trace of it alive or dead. From enquiries on the spot no one could suggest any reason, or that anything had happened to the water.

In August of 1925, in the Walberswick brackish water ditches, fine examples of this variety were found; but in August of this year (1926) they, too, had disappeared. Now did anything happen at Walberswick between August, 1925, and August, 1926, which would account for this strange disappearance? Yes. In November, 1925, there was an extremely high tide that did damage everywhere, and so these ditches had over-flowed, and I found that the water had carried the flotsam and jetsam of the ditches quite 200 to 300 yards inland; amongst this litter I found the var. *tenebrosa* all dead in the following August.

This is possibly the solution of the Walton disappearance—a series of high tides collecting and washing away the *tenebrosa*. *Littorina rudis* is gradually becoming a land shell, and thus can only live on the surface of the water, or at high-water mark, as in this case on the margins of the ditches.

The other species found in the ditches living at the bottom and hidden under the thick vegetation would escape removal for the most part.



The parasites of *Modiolus modiolus* (Linné).—This bivalve is very common off the South Sands at Tenby. On it were found *Hydroides norvegica*, *Serpula vermicularis*, *Scrupocellaria reptans*, *Plumularia silacea*, *Obelia geniculata*, and in it the crab *Pinnotheres pisum* and a Polychæte worm. Many of the specimens were enveloped by a sponge also.—ALAN GARDINER.

THE MOLLUSCA OF SOUTHWOLD.

By J. C. DACIE.

(Read before the Society, November 3rd, 1926).

My notes on the molluscan fauna of this quiet sea-side resort and its immediate neighbourhood during a stay there in April and August, 1925, and again in August of this year (1926) may, perhaps, be interesting.

MARINE SPECIES. Owing to the scour of the sea removing rather than depositing articles on the beach, these, both dead and alive, are scarce.

LAND SPECIES flourish in certain areas and, where found, are peculiar and interesting.

Helix nemoralis. On a certain embankment those with "undulate" and "spotted" bands are plentiful and appear to be a feature of this particular area, which produces black to brown, pink and white-lipped shells besides the vars. *bimarginata* (Pic.), *citrinozonata*, *roseozonata*, and that variety which has a white peripheral area without the dark band, *albocincta*. As to bands 12300, 12045, 00340, 00305, 10005 were collected.

Helix cantiana. For the most part these were small and peculiarly coloured, creating a local form.

Helix virgata. These also appear to be a local form, and a white variety of it is found, approaching the var. *hyalozona* Taylor. These white shells have, *i.e.* if they are perfectly cleaned (which is not easy), a *white* nucleus.

Helix caperata and **heripensis.** Where some chalk has been left from building operations these swarm and are very large. Specimens of the white var. of *H. caperata*, *obliterata* Picard, were collected, as well as of the white variety of *H. heripensis*, which latter is very rare.

Helix aspersa. This snail abounds in the neighbourhood of the coast, and its variety *minor* is plentiful, whilst intermediate shells between the normal and *minor* are plentiful too. Three mating couples were found, and in each case one of the smallest *minor* was *in cop.* with a normally-sized mate. I am suggesting that the *minors* act as males only, and that such a union produces *minors*, the intermediate and the normally-sized *aspersa*. Now these *minors* were not observed by us (3 of us) in 1925, but only in 1926. Did anything occur in 1925 that produced the *minor* race in 1926? Or was it in 1926? And what are the prospects

for 1927? As we are booked again for Southwold next August this point will be investigated. All the *aspersa* shells show a deficiency of lime, the locality being gravel and sand only.

BRACKISH-WATER SPECIES are to be found in ditches bordering the beach at Walberswick, which is across the river Blyth, and we collected *Cardium edule*, var. *rustica*, Jeffr., *Phytia myosotis*, *Sabanea ulvæ*, *Hydrobia ventrosa*, and *Littorina rudis* var. *tenebrosa* Mont. These last were specially sought for, and in 1925 large and beautifully marked specimens were found floating upon the water, or resting around the margins of these ditches. But in August last (1926), exactly a year later, these large *tenebrosa* had disappeared without trace, an experience I have met with before at Walton-on-Naze, Essex.



PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND.

554th Meeting, held at the Manchester Museum, March 2nd, 1927.

Mr. G. C. Spence in the chair.

Additions to the Library.

Reprints of papers by Dr. Paul Bartsch, Messrs. Hans Schlesch, A. S. Kennard and B. B. Woodward, A. E. Salisbury and B. B. Woodward (from the respective authors).

Large collection of papers and memoirs, including several by Dr. Rudolf Sturany, received in exchange for back numbers of the *Journal of Conchology*, from the Natural History Museum, Vienna.

New Member Elected.

Geo. W. Young.

Candidate Proposed for Membership.

Mrs. Elsie M. Morehouse, 23, Queen's Road, Doncaster (introduced by J. Digby Firth and J. A. Hargreaves).

Resignation.

Rev. E. L. Rowlands.

Members Deceased.

J. Darker Butterell.

Percy T. Deakin.

Paper Read.

"*Brachypodella (Gyraxis) emerita* sp. nov." by G. C. Spence.

Exhibits.

By Mr. G. C. Spence:—Specimens to illustrate his note; also others for comparison, and series of *Ennea*.

By Mr. C. H. Moore:—Series of small operculates, including *Heteropoma*, *Ditropis*, etc.

By Mr. E. R. Brown:—*Oliva smithi* from N. Caledonia; and *O. lepida*.

By Mr. H. de W. Marriott:—*Neptunea antiqua* (reversed) from Red Crag, Woodbridge; also set of cards issued by Cerebos Salt Co., showing various beautifully coloured shells.

The Special Exhibit was *Trivia*.

555th Meeting, held at the Manchester Museum, April 2nd, 1927.
Mr. G. C. Spence in the chair.

Additions to the Library.

Reprints of papers by Dr. W. H. Dall, Miss A. L. Massy, and Dr. Paul Pelseneer (from the respective authors).

Donations to Collections.

Malformed *Limnæa stagnalis* from Wistow, near Leicester, from A. E. Ellis.
Series of non-marine shells from Bornholm, etc., from Hans Schlesch.

New Member Elected.

Mrs. Elsie M. Morehouse.

Papers Read.

"An Abnormality in *Limnæa stagnalis* (L.)," by A. E. Ellis.
"Sinistral *Hygromia hispida* in Herts," by C. Oldham.

Exhibits.

By Mr. A. E. Ellis:—Specimen to illustrate his note.

By Mr. C. Oldham:—Dextral and sinistral *H. hispida* from Holocene shell-marl, in Herts, to illustrate his note.

By Mr. C. H. Moore:—Varied series of *Helicidæ*.

By Mrs. Gill:—Large series of *Trivia*.

By Mr. G. C. Spence:—Genus *Cleopatra*.



Stray Notes:—*U. tumidus*; in the river at Stafford there is, or was, a small though almost perfectly oval variety. *Anodonta cygnea*; in a roundish pond of about twelve feet diameter on the golf course north of Blackpool I once found specimens measuring six inches broad. A curious form occurs in the lake at Studley Park, Yorks.; these shells seem in some way to have lost their balance. Lying on a flat surface they have both hinge and outer margin equally raised, whereas all other normally shaped specimens that I have seen when so placed carry the hinge well raised and have the outer margin so deflected as almost to touch the supporting surface. Broad, short but cylindrical specimens have rewarded my searches in the canals at Lincoln and at Taunton. *Sphærium lacustre*; specimens of a variety taken by myself from the last-named spot remained in my cabinet for years labelled *S. pallidum*, until seen by Mr. J. W. Taylor, who identified them as *S. lacustre*.—W. GYNGELL.

ECOLOGY NOTES ON THE ZOSTERA BEDS IN THE HELFORD RIVER, CORNWALL.

By A. GARDINER, B.Sc.

THESE lie on the right bank about two miles up the inlet. The quantity of fresh water is small, such as there is being derived from a stream at the head of the inlet at Gweek, about 6 miles distant and from smaller rivulets which fall into numerous creeks which occur at intervals throughout the whole distance. This, combined with the very strong set of the tide, causes a high salinity.

A dead shell revealed the presence of *Haminæa navicula* (da Costa). A considerable number of specimens of this species was then found by thrusting the hands from 4 to 6 inches into the mud and feeling around the roots of the *Zostera*. We failed to find any moving about even in the submerged portions of the bed, so that the animals appear to spend at all events most of their time covered by mud.

Zippora membranacea, *Bittium reticulatum*, *Calliostoma striatum* and *montacuti* occurred in thousands on the weed when submerged, but were difficult to find when it was high and dry. Crawling on the mud were *Aplysia punctata*, *Oscanius membranaceus*, *Archidoris tuberculata*, *Cadlina obvelata*, but at this time of the year, August and September, no *Æolis papillosa* were found, although they occur on the same ground in the spring and early summer.

The Gephyreans, *Phascolosoma pellucidum* and *Synapta digitata* occurred in considerable numbers; in their burrows were found a few examples of *Montacuta bidentata* and some small *Lepton*. We looked for *Gebia* without success, although it had been recorded for this place by the late Mr. Howard Fox, of Falmouth. Failing to find this crustacean, we naturally did not find *Lepton squamosum*.

Cardium exiguum and *nodosum* were found in some numbers, but the latter species was obtained in greater plenty by dredging.

Scrobicularia plana was far commoner on the other bank of the river at a point very close to the mouths of two fresh water streams.

Solen vagina was picked up alive on the beach where they had been deposited by people working with a shrimp net from a boat.

Flanking the *Zostera* beds lies one of sand with some mud; here were found *Ensis ensis*, and *siliqua*, *Mya arenaria*, all four species of *Tapes*, *Chamelæa gallina*, *Mactra stultorum*, *Spisula solida* and *subtruncata*, as well as *Gari ferroensis* and *Tellina squalida* washed up by the tide. Shells of *Lutraria elliptica* were also common; this species must live here, as its appearance is constant to my knowledge for the past 20 years.

At a slightly higher level there is an extensive cockle bed where *Mytilus edulis* and its var. *galloprovincialis* are common. It was noticed that the var. seemed to occur in the higher and more stony parts of the bed.

Whilst dredging off Durgan, about a mile distant, *Meretrix chione* was secured, associated with the rarer hermit crabs *Pagurus fasciatus*, *dillwynii*, *lævis* and *cuanensis*. One of the latter was found in a sponge in the *Zostera*.

Meretrix chione must be very numerous here in fairly shallow water, as it is found thrown up during winter storms from the East.

EDITORIAL NOTES.

It is with the very greatest regret that we announce the losses that Conchology has suffered during the last few months.

On September 14th last, Charles Hedley died rather suddenly at his home at Mosman, Sydney, when he was packing up for a journey to Japan to attend the Pan-Pacific Science Congress. Some time before he had strained his heart in working too vigorously on the Barrier Reef, but no one seems to have anticipated a fatal result.

Born in Yorkshire in 1862, Hedley went out to Australia as a young man and, after working for some time on the land in Queensland, obtained a berth in the Brisbane Museum, and subsequently accompanied the Macgregor Expedition to British New Guinea. In 1891 he joined the staff of the Australian Museum at Sydney, became Conchologist there in 1896, and in 1908 Assistant Curator.

In 1920, R. Etheridge, Junior, died, and Hedley became Acting Curator, but in 1925 he left the Australian Museum to become Scientific Director of the Great Barrier Reef Investigation Committee—a post for which his tastes and his knowledge peculiarly fitted him.

He was not only one of the finest conchologists of this or any other generation, but his knowledge of botany and ethnography was equally good, and the study of zoogeography he had always made peculiarly his own. He had travelled largely in the Pacific, especially in the region of Torres Straits, and was a member of the Royal Society of London's Expedition to Funafuti when they examined the construction of the atoll by boring.

Hedley was last over here in 1912 and spent a considerable time in studying the Australian material at the British Museum. During this tour he also visited the Hancock Museum at Newcastle to see the Angas collection of Land Shells, the Paris and Geneva Museums to study Lamarck's types, and the U.S. National Museum at Washington. The results and conclusions derived from these studies are mainly set forth in ¹part xi of his most valuable and interesting "Studies on Australian Mollusca."

Those who had the opportunity and privilege of fairly close and intimate association with him during this lengthy visit to England will never tire of recalling the extraordinary magnetism of his personality, the absorbing interest of his experiences and the comprehensiveness of his knowledge.

There is only space to mention a few of his contributions to conchology. The Australian Studies have already been mentioned—part xiv and last appeared in P.L.S.N.S.W., xlvi, 1923. I select the following works also as of more than ordinary value:

- "Check-List of the Marine Fauna of New South Wales." Pr. Roy. Soc. N.S.W., li, 1918.
- "Revision of the Australian Turridæ." Rec. Austral. Mus. xiii, 1922.
A work of about 145 p.p. and 15 splendid plates, revolutionising the study of the Turridæ and of far reaching importance to students of this family outside Australia.
- "Scientific Results of the Trawling Expedition of H.M.C.S. Thetis." Mem. Austral. Mus. iv, 1902-3.
- "Mollusca from the Hope Islands, North Queensland." P.L.S.N.S.W. xxxiv, 1909.
- "Marine Fauna of Queensland." Austral. Assoc. Advancement Sci., 1909.
- "Preliminary Index of the Mollusca of Western Australia." J. Roy. Soc. W.Austral., i, 1915.
- "Revised Census of the Terrestrial Mollusca of Tasmania," by Petterd and Hedley, Rec. Austral. Mus., vii, 1909.
- "The Land Molluscan Fauna of New Guinea." P.L.S.N.S.W., (2) vi, 1891, with two supplements.
- "Review of the Australian Tun-Shells." Rec. Austral. Mus., xii, 1919.
- "Report on Mollusca obtained by F.I.S. Endeavour." 2 parts, 1911 and 1914.
- "Revision of Australian Tridacna." Rec. Austral. Mus., xiii, 1921.
- "Mollusca of Mast Head Reef, Queensland." P.L.S.N.S.W., xxxi, 1906, and xxxii, 1907.
- "Mollusca of Funafuti." Mem. Austral. Mus. iii (3 parts), 1899.

Hedley was always up-to-date to the utmost of his knowledge, and his systematic papers are particularly instructive and useful for reference in that they gather up the latest items relating to distribution, synonymy and nomenclature. Thus he was quick to recognise the validity of the Boltenian names and the unpleasant necessity of using them.

The United States have suffered severe losses by the following recent deaths:

Dr. William Healey Dall died on March 27th last at the age of 82.

Dr. A. E. Ortmann died at Pittsburgh, Pa., on January 3rd, in the 64th year of his age. A native of Magdeburg, Prussia, he was born on April 8th, 1863, and went to America in 1894, first as Curator in Invertebrate Paleontology at Princetown University, and subsequently as Curator in Invertebrate Zoology at the Carnegie Museum, Pittsburgh. Some of his early work was on Cephalopods; later he wrote much on zoogeography, but some twenty years ago he returned to the Mollusca and devoted his studies to the American Naiads, on which he has of recent years been the chief American authority, both in morphology and in classification.

Professor Addison Emery Verrill, who also died this spring, was born in 1839, and studied under Prof. Louis Agassiz at Harvard. He was professor of Zoology at Yale from 1864 to 1907, and wrote much on the Marine Invertebrates of the Atlantic coast. He is perhaps best known now for his monograph on Bermuda, comprising the history, geology, and zoology of the island.

James H. Ferriss died at Joliet, Ill., on March 17th, 1926, aged 77. His name is probably known best over here in connexion with the Ancyloid genus *Ferrissia*, but he was noted across the water as the foremost collector of land-shells in America. Pilsbry says of him—"as a collector he has probably never been surpassed. Ferriss found more new land-shells than any American since the time of Thomas Say." By profession he was a journalist.

In the last few days news has come to hand of the death of the Marchese di Monterosato, but further details are at present wanting.

Adolf d'Ailly, well known as a writer on African Pulmonates, died recently at Stockholm.

Professor G. O. Sars died nine days before the celebration of his ninetieth birthday, which he would have attained on April 20th.

As he was one of our Hon. Members, a letter of congratulation was about to be despatched to him on behalf of the Society.

An interesting list of the L. & F. W. Mollusca of the Oxford district by Rev. L. W. Grensted appeared in the Brit. Association Handbook which was issued last year (1926) for the Oxford meeting. The notes on *Pisidia* are of special interest in view of the comparative uselessness of old records for this group.

The Collier collection of land-shells, which remained in the hands of the family after Mr. Edward Collier's death, has now been donated as follows:—

The Land Operculates to the Manchester Museum.

All the African material to Mr. G. C. Spence.

The remainder to the Altrincham Museum.

The Tenth International Congress of Zoology, postponed from 1916 owing to the war, will be held this year at Budapest, from September 4th to 9th, under the Presidency of Dr. G. Horváth, Director of the Hungarian National Museum.

From observations made on slugs in captivity K. Künkel (Abderhalden's *Hand. d. biol. Arbeitsmeth.* part 207, 1926, p. 582) concludes that *Arion ater*, *A. subfuscus*, *A. circumscriptus*, *A. minimus* and *Limax tenellus* have a natural length of life of 12 to 14 months, and become sexually mature at 7 to 10 months. *Limax arborum*, *L. cinereoniger*, *L. flavus* and *Amalia sowerbyi* live 2 to 3 years. It is interesting to note that the pests *Arion hortensis* and *Limax agrestis* live about a year, but may be mature in as little as 4 months; they also breed at almost any time of year, while the other species have definite seasons. It is of importance that these data should be checked by field observations.

In "Nature" for January 1st, 1927, p. 9, Boycott and Diver describe an albino variety of *Limnaea peregra* which appeared in the course of their breeding experiments on sinistrality. It shows very clearly the Mendelian character of albinism, and if anyone would like to breed it for themselves Prof. Boycott (17, Loom Lane, Radlett) will be glad to send some of the surplus young.

A.E.B.

The following extract is from "Nature," January 1st, 1927.—Formation of Calcareous Tubes round the Siphons of *Teredo*.—At the beginning of June, 1926, a quantity of wood heavily infected with *Teredo* (probably all *Teredo norvegica*), taken from the experimental rafts moored near the Plymouth breakwater, was placed in one of the tanks in the Plymouth laboratory. It was left undisturbed for almost four months, and when examined at the end of September was found covered with faecal deposits consisting of wood fragments cut away by the shell valves of *Teredo* and passed out by the way of the exhalent siphons. These deposits were, on the average, rather less than half-an-inch thick, and when they were washed away there were revealed projecting from the wood great numbers of fine calcareous tubes, which on closer examination proved to occur always in pairs and to project from the openings of the burrows formed by the shipworms. Plainly the tubes had been formed around the siphons of the *Teredo*. They were of varying length, depending presumably on the thickness of the deposits, the longest being some two-fifths of an inch. Normally the external openings of the tubes of *Teredo* are very difficult to distinguish, consisting of a pair of minute openings ringed with calcareous matter out of which project the siphons and within which these are immediately withdrawn on stimulation. The presence of faecal deposits, which had accumulated to an abnormal degree owing to the lack of water currents to remove them, would tend to obstruct the passage of the siphons and so endanger the life of the animals within. The response of the animals to this abnormal and dangerous state of affairs was to lay down calcareous tubes around the siphons, which by this means were able to maintain free contact with the water.

Dr. W. T. Calman has directed my attention to the fact that the giant shipworm *Kuphus arenarius*, which lives vertically embedded in the mud of mangrove swamps in the Pacific, normally has the siphons encased in this manner, a fact which was known to Rumphius so far back as 1741, and was figured by him as *Solen arenarius*. This animal lives normally under conditions in which the *Teredo* in the Plymouth tank lived for some four months, namely, in constant danger of being suffocated by accumulating deposits—in one case of mud, in the other of faecal matter. This accidental production of calcareous siphon tubes in *Teredo* is therefore of considerable interest, since it provides a very striking case of an immediate and highly successful response by an animal to changed environmental conditions; a response, moreover, which has taken the form of a permanent adaptation in related animals living under conditions very similar to those accidentally produced.—C. M. YONGE.

From a copy of "The Yorkshire Evening News" (March 15th, 1927) we gather that a movement is on foot in Leeds to "recognise in a tangible form the splendid work done in the cause of education" by Mr. Henry Crowther, one of our Hon. Members and an original member of the Society. He has been associated with the Leeds Museum for 43 years, and for 25 of those years has been Hon. Lecturer under the Leeds Schools' Museum scheme which he helped to initiate in 1901.

From the Leiden Museum of Natural History comes an excellent monograph of some sixty-five pages by Dr. A. L. J. Sunier on *Vertigo substriata* Jeff. as a Dutch species. It was first found in 1925 and has since then been taken in some numbers—all at Meer en Bosch with the exception of a single example at Noordwijkerhout. The author gives exhaustive details, including measurements, of the finds, and discusses the ecological and geographical distribution of the species. He also summarises what is known of its occurrence "avant et pendant les temps glaciaires pleistocènes."

Mr. J. W. Jackson wrote last year in the "North Western Naturalist" on Recent Cave Exploration in Derbyshire. The results have been extremely interesting and fruitful, especially in relation to man and early mammals.

The Trans. N. Z. Inst. lvi (1926) contains an important paper by W. R. B. Oliver on Australasian Patelloididæ (olim Acmaeidæ). It contains a key to the systematic relationship of all the genera so far described, in addition to a monograph of the Australian and New Zealand forms, with notes on the world-range of the family and radular characteristics of the different genera. The author concludes that the name *Tectura* should stand for our British species, the group being characterised by thin, smooth, more or less translucent shells, and a radula whose formula is 0.2.2.2.0.

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CONCHOLOGY.

FOUNDED 1874.

BEING THE ORGAN OF THE CONCHOLOGICAL SOCIETY
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T H E
JOURNAL OF CONCHOLOGY.

VOL. 18.

DECEMBER, 1927.

No. 6

THE MOLLUSCA OF THE 'ST. GEORGE' EXPEDITION.

(I). THE PACIFIC COAST OF S. AMERICA.

(Read before the Society, November 2nd, 1927).

THE S.Y. 'St. George' was sent out in 1924 with a party of scientists to the Pacific, via the Panama Canal.

The marine Mollusca were practically all collected by Dr. James Hornell, late Director of Fisheries at Madras, and the material gathered by such expert hands is particularly rich and interesting, as one would expect.

Dr. Hornell's short monograph on "The Common Molluscs of South India" (Madras Fisheries Bulletin, vol. xiv, pp. 97-215) is an admirable exposition which is far too little known.

Some small gatherings of Marine Mollusca were made in the West Indies, with which I hope to deal in a subsequent number. The present paper treats of the marine collections from Panama onwards.

The Expedition visited certain groups of islands in Polynesia, but no marine shells were collected there.

The chief localities visited off South America were as follows :

Panama.

Isla del Rey, one of the Pearl Archipelago in the Bay of Panama.

Taboga Is., in the Bay of Panama—not to be confused with Tobago in the West Indies.

Coiba Is. and Jicaron Is., west of the Bay of Panama, beyond the Azuero Peninsula.

Gorgona Is., off the Colombian coast, near the 3rd parallel of N. latitude.

The Galapagos group—the islands visited being Charles, James, Albemarle, Narborough and Indefatigable.

Cocos Is., some 400 miles from the coast of Costa Rica in the direction of the Galapagos. This island is well known for the numerous treasure-hunts that have taken place there, and parts of it are described as honeycombed with excavations.

CLASS AMPHINEURA.

Order POLYPLACOPHORA.

Family ISCHNOCHITONIDÆ.

Ischnochiton (Stenoplax) limaciformis (Sow.).

Chiton limaciformis Sowerby, P.Z.S. 1832, p. 26, 21/4/1832.

Jicarón Is., living. Known from both sides of the Isthmus of Panama: it is common in the West Indies and recorded by Dall from Mazatlan to the Lobos Isles in Peru.

Family CHITONIDÆ.

Chiton stokesii Broderip, P.Z.S. 1832, p. 25, 21/4/1832.

Cocos Is., common, living on the shore.

This is an extension of its range. It has occurred down the S. American coast as far as Arica.

Chiton (Radsia) sulcatus (Wood).

Chiton sulcatus Wood. Gen. Conch. p. 16, pl. iii, f. 1, 1815.

Narborough Is., shore, living. A well-known Galapagos species.

Tonica crenulata (Brod.).

Chiton crenulatus Broderip, P.Z.S. 1832, p. 27, 21/4/1832

Charles Is., one living.

CLASS GASTROPODA.

Order PULMONATA.

Family SIPHONARIIDÆ

Siphonaria characteristica Reeve.

Conch. Syst. II, pl. cxxxviii, f. 3, 1842.

Cocos Is., living. Sometimes considered a variety of *S. gigas* Sow.

Williamia galapagana Dall.

Pr.U.S. Nat. Mus. xxxvii, p. 205, 24/11/1909.

Charles Is., dead. Described from Panama, Galapagos Is., etc.

Family ELLOBIIDÆ

Melampus tabogensis (C. B. Ad.).

Auricula tabogensis C. B. Adams, Ann. Lyc. Nat. Hist. New York V, p. 435, July 1852.

Gorgona Is., living under logs just above high-water-mark. Described from Taboga Is. and Panama.

Order CTENOBRANCHIATA.

Family TEREBRIDÆ

Terebra strigata Sow.

Tankerville Cat., App. p. xxiii, 1825.

Coiba Is., two dredged dead in 10-12 f. Widely spread from the Gulf of California to Payta, and in the Galapagos.

T. larvæformis Hinds.

P.Z.S. 1843, p. 155, June, 1844.

Coiba, one, small, in 10 f. Recorded from S. Elena and Guayaquil.

T. aspera Hinds.

P.Z.S. 1843, p. 154, June 1844.

Living on shore at Isla del Rey and Gorgona Is.

T. armillata Hinds.

P.Z.S., l.c.

James Is., living; a smoother var. with less prominent tubercles dredged commonly at Indefatigable Is. This and the last are not uncommon species in the Panamic province.

T. lingualis Hinds.

P.Z.S. 1843, p. 153, June 1844.

Coiba, dredged alive in 10 f. Originally found in the Gulf of Papagayos.

Family CONIDÆ.

Conus brunneus Wood.

Ind. Test. Suppl. p. 8, pl. iii, f. 1, 1828.

Cocos Is. living; Gorgona Is., young specimens common alive; James Is., one living; Charles Is., living and dead—in all cases on shore. A widespread species.

C. gladiator Broderip.

P.Z.S. 1833, p. 55, 24/5/1833.

Panama, living on shore; dead at Tagus Cove, Albemarle Is.

C. vittatus Bruguière.

Enc. Méth., Vers, I, pt. ii, p. 704, 1792.

One living at James Is.

C. orion Broderip.

P.Z.S. 1833, p. 55, 24/5/1833.

Gorgona Is., several living on shore.

C. regularis Sowerby.

Conch. Ill. pt. 36, f. 45.

Coiba, dead; Isla del Rey, one fine living example on shore; Gorgona, one living.

C. daucus Bruguière.

Enc. Méth., Vers, I, pt. ii, p. 651, 1792.

James Is., one living.

Conus purpurascens Sowerby.

P.Z.S. 1833, p. 54, 24/5/1833.

Coiba, living in 10-12 f., a form with unusually high spire; dead on Indefatigable Is., living on Charles Is. and Albemarle Is. (Tagus Cove). This species ranges from the Gulf of California to Payta.

Conus ximenes Gray.

Zool. Beechey's Voyage, Moll. p. 119, 1839.

One living on Indefatigable Is.

Known from the Gulf of California to Sechura Bay, Peru.

Conus mahogani Reeve.

Conch. Icon. I, pl. xxii, f. 126, Aug. 1843.

Panama, alive on the shore.

Conus lucidus Wood.

Index Test. Suppl. p. 8, pl. iii, f. 4, 1828.

Charles Is., dead; several living on James Is. and Albemarle Is. (Tagus Cove).

Conus tornatus Broderip.

P.Z.S. 1833, p. 53, 24/5/1833.

Several dredged at Coiba, alive and dead; one measures about 30 mm. in length.

Not known lower than the Ecuador coast.

Family TURRIDÆ.

Surcula tuberculifera (Brod. & Sow.).

Pleurotoma tuberculifera Broderip & Sowerby, Zool. Journ. IV, 378, Jan. 1829.

Coiba, one dead, 10 f.: Jicaron, small living.

Surcula albicarinata (Sow.).

Pleurotoma albicarinata Sowerby, P.Z.S. 1870, p. 253, 1870.

Coiba, dead, 10-12 f.: Gorgona, common living on shore, and dredged living in 15 f.

Originally from Manzanilla.

Crassispira militaris (Hinds).

Clavatula militaris Hinds, P.Z.S. 1843, p. 38, Oct. 1843.

Coiba, dredged dead.

Originally from Veragua and Panama.

Crassispira tomliniana Melvill.

Pr. Malac. Soc. XVII. 155, pl. xii, f. 2, May 1927.

One dredged living at Coiba. The type was collected on the shore of Gorgona Is. by Dr. Hornell.

Crassispira nigerrima (Sow.).

Pleurotoma nigerrima Sowerby, P.Z.S. 1833, p. 137, 16/4/1834.

One live example collected on shore at Gorgona—a variety with the axial ribs shorter and more prominent than in the type.

Known from Gulf of California to Ecuador.

Crassispira albicostata (Sow.).

Pleurotoma albicostata Sowerby, P.Z.S. 1833, p. 135, 16/4/1834.

James Is., living.

Described from the Galapagos.

Crassispira fuscescens (Reeve).

Pleurotoma fuscescens Reeve, Conch. Icon. I, pl. xv, f. 125, July 1843.

Coiba, one dead.

Described from unknown locality.

Crassispira unicolor (Sow.).

Pleurotoma unicolor Sowerby, P.Z.S. 1833, p. 138, 16/4/1834.

Coiba, one living.

Ancistrosyrix cedo-nulli (Reeve).

Pleurotoma cedo-nulli Reeve, P.Z.S. 1843, p. 185.

One small live example dredged at Gorgona in 20 f., colour red. Originally from Panama.

Family CANCELLARIIDÆ.

Cancellaria hæmastoma Sowerby.

P.Z.S. 1832, p. 54, 5/6/1832.

Taken alive and dead on the shore at Tagus Cove, Albemarle Is.

Described from the Galapagos.

Cancellaria gemmulata Sowerby.

P.Z.S. 1832, p. 55, 5/6/1832.

Dead at Tagus Cove.

Cancellaria funiculata Hinds.

P.Z.S. 1843, p. 48, Oct. 1843.

Several dredged dead at Gorgona.

Cancellaria indentata Sowerby.

P.Z.S. 1832, p. 54, 5/6/1832.

Coiba, one dead, 10-12 f.

Family OLIVIDÆ.

Oliva fuscata Marrat (?).

Thes. IV, *Oliva*, p. 4, pl. ii, f. 20-22, 1870.

One dead on shore at Gorgona, in poor condition, but probably *fuscata*. A Lower Californian species.

Oliva polpasta Duclos.

Genre Olive, pl. xvi, f. 1, 2, 1840.

Isla del Rey, common living.

Olivella volutella (Lam.).

Oliva volutella Lamarck, Ann. Mus. (Paris) xvi, p. 322, 1811

Panama and Coiba, living on shore.

Occurs as far north as the Gulf of California.

Family HARPIDÆ.

Harpa crenata Swainson.

Cat. Shells Coll. Bligh, App. p. 5, 1822.

Gorgona, young exx. common alive.

Ranges from Panama to Acapulco.

Family MARGINELLIDÆ.

Marginella rubella C. B. Adams.

Pr. Boston Soc. Nat. Hist. II, p. 1, 1845.

Charles Is., alive; Indefatigable Is., dead in shingle; Tagus Cove, Albemarle Is., dead—a brown var. with narrow white band in middle.

Marginella minor C. B. Adams.

Ann. Lyc. N.H. N. York V, p. 264, 1852.

Indefatigable Is., common in shingle.

Recorded from Mazatlan to Panama.

Persicula porcellana (Gm.).

Voluta porcellana Gmelin, Syst. Nat., ed. xiii, p. 3449, 1791.

Jicaron Is., one beautiful live shell.

Persicula phrygia (Sowerby).

Marginella phrygia, Sowerby, Thes. I, p. 394, pl. lxxviii, f. 218, 219, 1846.

Dead shells in shingle from Charles and Indefatigable Is. Gulf of California to Acapulco.

Family MITRIDÆ.

Mitra lineata (Broderip).

Tiara lineata Broderip, P.Z.S. 1835, p. 195, 8/4/1836.

Gorgona, dredged living in 15 f.; living on James Is.

Mitra attenuata Reeve.

Conch. Icon. II, pl. xvi, f. 124, Oct. 1844.

Gorgona, one small dead shell.

Mitra rupicola Reeve,

Conch. Icon. II, pl. viii, f. 53, Sept. 1844.

Gorgona, shore, living; two specimens dredged alive at Taboga may be a very narrow var. of this species.

Strigatella tristis (Brod.).

Mitra tristis Broderip, P.Z.S. 1835, p. 194, 8/4/1836.

Narborough Is., dead; Charles Is., living.

Known also from Mazatlan to Panama.

Family FASCIOLARIIDÆ.

Fasciolaria princeps Sowerby.

Tankerville Cat., App. p. xvi, 1825.

Gorgona, living and dead.

Ranges from the Gulf of California to Peru and the Galapagos.

Fasciolaria salmo (Wood).

Murex salmo Wood, Index Test. Suppl. p. 15, pl. v, f. 14, 1828.

One living on shore, Isla del Rey.

Latirus varicosus (Reeve).*Turbinella varicosa* Reeve. Conch. Icon. IV, pl. ii, f. 6, July 1847.

Gorgona, living on shore; Charles Is., several ditto.

Latirus tuberculatus (Brod.).*Turbinella tuberculata* Broderip, P.Z.S. 1833, p. 7, 17/5/1833.

Charles Is., living on shore.

This and the last are Galapagos species.

Latirus ceratus (Wood).*Murex ceratus* Wood, Index Test. Suppl. p. 15, pl. v, f. 15, 1828.

Panama, living on shore.

Ranges from Mazatlan to Manta and the Galapagos.

Latirus concentricus (Reeve).*Buccinum concentricum* Reeve, Conch. Icon. III, pl. x, f. 72, Dec. 1846.

Jicarón Is., living on shore.

Latirus tumens Carpenter.*Latyrus tumens* Cpr., P.Z.S. 1856, p. 166, 11/11/1856.

Gorgona, living on shore.

These two are species of the Panamic province.

Leucozonia cingulata (Lam.).*Monoceros cingulatum* Lamarck, An. s. Vert. VII, p. 250, Aug. 1822.

Panama, living on shore.

This well-known species occurs commonly from Mazatlan to Panama.

Family FUSINIDÆ.

Fusinus dupetitthouarsi (Kiener).*Fusus dupetitthouarsi* Kiener, Coq. Viv., p. 15, pl. xi, 1840.

Albemarle Is., not uncommon alive.

Originally described from "Coast of California."

Family BUCCINIDÆ.

Austrofusus fontainei (Orb.).*Fusus fontainei* Orbigny, Voy. Am. Mérid. V, p. 447, pl. lxiii, f. 2, 1841.

Panama, one living on shore.

Originally from Mexillones and Callao.

Polia sanguinolenta (Duclos).*Purpura sanguinolenta* Duclos, Mag. Zool. III, pl. xxii, f. 1, 1833.Taken alive at Gorgona in colonies of *Pocillopora*, Panama, Charles Is. and Tagus Cove, Albemarle Is.

It occurs up the coast to Mazatlan.

Polia bilirata (Reeve).

Buccinum biliratum Reeve, Conch. Icon. III, pl. x, f. 71, Dec., 1846.

Tagus Cove, living on shore.

Described from the Galapagos.

Engina crocostoma (Reeve).

Ricinula crocostoma Reeve, Conch. Icon, III, pl. v, f. 40, Sept., 1846.

Taboga Is., dredged alive; living on Gorgona shore in colonies of *Pocillopora*, and at Tagus Cove.

Erroneously given as a Philippine species by its author.

Engina maura (Sow).

Columbella maura Sowerby, P.Z.S. 1832, p. 117, 14/8/1832.

Living on shore at Panama, Jicaron Is., Isla del Rey, and James Is.

Engina livida (Sow.).

Columbella livida Sowerby, l.c.

Dredged alive at Taboga, Gorgona and Galapagos (island not specified).

Metula clathrata (A. Ad. & Reeve).

Buccinum clathratum A. Adams & Reeve, Zool. Voy. 'Samarang,' pt. vi, p. 32, pl. xi, f. 12, 1/5/1850.

A large dead shell, somewhat imperfect but unmistakable, dredged off Gorgona.

Originally described from deep water off the Cape, but that locality, like many others in the 'Samarang' work, is certainly erroneous. I can confirm the West American one by an authentic specimen from Balboa in my own collection.

Phos veraguensis Hinds.

Voy. 'Sulphur,' p. 37, pl. x, f. 13, 14, 1844.

Coiba, dead on shore, and dredged alive in 10 f.

Phos gaudens Hinds.

Voy. 'Sulphur,' p. 38, pl. x, f. 5, 6, 1844.

A small dead, fresh example dredged off Gorgona.

Family NASSARIIDÆ.

Nassarius polygonatus (Lam.).

Buccinum polygonatum Lamarck, An. s. Vert. VII, p. 278, Aug., 1822.

Common living on shore at Coiba and at Gorgona.

Cuming's Philippine locality must be an error.

Nassarius nodicinctus (A. Ad.).

Nassa nodicincta A. Adams, P.Z.S. 1851, p. 110, 7/12/1852.

Taken alive commonly on shore at Coiba, Gorgona, Indefatigable Is. (rather a small race) and James Is.: dredged also at the last locality alive in 17 f.

Nassarius versicolor (C. B. Ad.).

Nassa versicolor C. B. Adams, Ann. Lyc. N. Hist. N. York, V, p. 290, June 1852.

Gorgona, dead shells : dredged alive at Taboga, James Is. in 17 f., Galapagos (no island specified).

Recorded also from Mazatlan to Panama. Taboga was the original locality.

Family PYRENIDÆ.

Pyrene fuscata Sowerby.

P.Z.S. 1832, p. 117, 14/8/1832.

Living at Charles Is., James Is., Indefatigable Is. and Tagus Cove : an adult from the last locality is only 13 mm. long.

Pyrene hæmastoma Sowerby.

l.c., p. 116, 14/8, 1832.

Gorgona, a small var. living in colonies of *Pocillopora* ; Charles Is. and James Is., living.

Pyrene major Sowerby.

l.c., p. 119, 14/8/1832.

Living on Jicaron Is.

Pyrene uncinata Sowerby.

l.c., p. 114, 14/8/1832.

Dredged alive at Gorgona and James Is. (17 f.) ; dead shells at Indefatigable Is.

Pyrene castanea Sowerby.

l.c., p. 118, 14/8/1832.

Living at Tagus Cove, Albemarle Is. and at James Is. ; Narborough Is., common on shore, mostly dead.

Pyrene fulva Sowerby.

l.c., p. 115, 14/8/1832.

Panama, living on shore.

Pyrene festiva Kiener.

Columbella festiva Kiener, Coq. Viv. p. 15, pl. xi, f. 4, 1841.

One dredged alive at Gorgona.

Ranges from Lr. California to Acapulco.

Anachis lyrata (Sow.).

Columbella lyrata Sowerby, P.Z.S. 1832, p. 114, 14/8/1832.

Panama, living on shore.

Anachis varicosa (Gaskoin).

Columbella varicosa Gaskoin, P.Z.S. 1851, p. 5, 28/10/1852.

Coiba, one live specimen on shore.

Anachis rugosa (Sow.).

Columbella rugosa Sowerby, P.Z.S. 1832, p. 115, 14/8/1832.

Living at Isla del Rey.

Anachis coronata (Sow.).*Columbella coronata* Sowerby, l.c. p. 114, 14/8/1832.

Taboga Is., dredged alive commonly.

Anachis pygmæa (Sow.).*Columbella pygmæa* Sowerby, l.c. p. 119, 14/8/1832.

Dredged alive at Gorgona.

Strombina gibberula (Sow.).*Columbella gibberula* Sowerby, l.c. p. 115, 14/8/1832.

Dredged alive at Gorgona.

Strombina lanceolata (Sow.).*Columbella lanceolata* Sowerby, l.c. p. 116, 14/8/1832.

Common alive on James Is. and at Tagus Cove, Albemarle Is.

Strombina recurva (Sow.).*Columbella recurva* Sowerby, p. 115, 14/8/1832.

Living on Jicaron Is.; Dredged alive at Coiba in 10-12 f.

Strombina maculosa (Sow.).*Columbella maculosa* Sowerby, l.c. p. 116, 14/8/1832.

Gorgona, common living on shore and in 15 f.

All the above Columbellids are endemic on the W. coast of Central America, their southern limit being about Payta.

Nitidella sertulariarum Orb. (?).*Columbella sertulariarum* Orbigny, Voy. Am. Mérid. V, p. 431, pl. lxi, f. 13-17, 1841.

One live shell from Cocos Is. is referred here very doubtfully.

Family MURICIDÆ.

Phyllonotus princeps (Sow.).*Murex princeps* Sowerby, P.Z.S. 1832, p. 176, 14/1/1833.

Living on James Is. and Albemarle Is.

A well-known West Coast shell.

Phyllonotus funiculatus (Reeve).*Murex funiculatus* Reeve, Conc. Icon. III, pl. xix, f. 74, June 1845.

Isla del Rey, dead.

Phyllonotus brassica (Lam.).*Murex brassica* Lamarck, An. s. Vert. VII, 167, Aug. 1822.

One young live example at Gorgona.

Ranges from Mazatlan to Peru.

Phyllonotus lappa (Brod.).*Murex lappa* Broderip, P.Z.S. 1832, p. 177, 14/1/1833.

Dredged alive at Taboga and on shore at Coiba.

Ranges from Mazatlan to Guayaquil.

Phyllonotus oxyacantha (Brod.).

Murex oxyacantha Broderip, P.Z.S. 1832, p. 176, 14/1/1833.

Jicaron Is., living; dredged alive at Gorgona.

Homalacantha norrisii (Reeve).

Murex norrisii Reeve, Conch. Icon. III, pl. xxviii, f. 129, Aug., 1845

Dredged alive at Gorgona.

Tritonalia erosa (Brod.).

Murex erosus Broderip, P.Z.S. 1832, p. 174, 14/1/1833.

One live specimen from colony of *Pocillopora* at Gorgona.

A species of the Panamic Province.

Aspella anceps (Lam.).

Ranella anceps Lamarck, An. s. Vert. VII, p. 154, 1822.

A dead shell in dredgings from Gorgona.

It seems almost impossible to deny an almost world-wide range to this shell. Tryon was unable to find any variation in examples from Torres Str., Japan, Fiji, Hawaii, Panama and W. Indies: S. African shells also seem to be identical.

Vitularia salebrosa (King).

Murex salebrosus King, Zool. J. V, p. 348, July 1832.

A young specimen dredged at Gorgona.

Recorded by Tryon from Mazatlan to Panama.

Eupleura nitida (Brod.).

Ranella nitida Broderip, P.Z.S. 1832, p. 176, 14/1/1833.

Living on shore at Panama.

Caducifer crebristriatus (Cpr.).

Triton crebristriatus Carpenter, P.Z.S. 1856, p. 165, 11/11/1856.

Dead shells dredged at Coiba and Gorgona.

Family THAIDIDÆ.

Thais patula (L.).

Taken alive on Cocos Is., James Is., Charles Is., and very fine on Indefatigable Is.

Ranges also from Gulf of California to Peru.

Thais kiosquiformis (Duclos).

Purpura kiosquiformis Duclos, Ann. Sci. Nat. XXVI, p. 107, pl. i, f. 5, May 1832.

Panama, living; also living on the breakwater at Colon. Not previously recorded from the north side of the Isthmus.

Known from Magdalena Bay to Tumbes (Peru).

Thais planospira (Lam.).

Purpura planospira Lamarck, An. s. Vert. VII, p. 240, Aug. 1822.

Indefatigable Is., dead.

On the mainland known from Lr. California to Peru.

Thais janellii (Kiener).

Purpura janellii Kiener, Coq. Viv. p. 122, pl. xxxviii, f. 89, 1836.

Charles Is., dead; living on Indefatigable and Albemarle Is.

Thais crassa (Blv.).

Purpura crassa Blainville, Nouv. Ann. Mus. I, p. 241, pl. xii, f. 4, 1832.

Living at Panama and on James Is.

Extends southward to Callao.

Thais callaoensis (Gray).

Purpura callaoensis Gray, Spic. Zool. i, p. 4, pl. vi, f. 11, 1/7/1828.

Narborough Is., living.

Charles Is. (Stearns); Panama to Callao (Dall).

Cymia tectum (Wood).

Buccinum tectum Wood, Ind. Test. Suppl. p. 12, pl. iv, f. 13, 1828.

One large live example from Panama.

Known as far south as Manta.

Acanthina grandis (Gray).

Monoceros grande Gray, Zool. Beechey's Voyage, p. 124, 1839.

Narborough Is., dead; Tagus Cove, living.

Apparently confined to the Galapagos.

Family CORALLIOPHILIDÆ.

Coralliophila distans (Cpr.).

Rhizocheilus distans Carpenter, Cat. Mazatlan Shells Brit. Mus. p. 484, 1857.

Narborough Is., dead; Tagus Cove, living.

Also a Panama species.

Coralliophila costata (Blv.).

Purpura costata Blainville, Nouv. Ann. Mus. I, p. 231, pl. xi, f. 8, 1832.

Taboga, dredged dead; living at Tagus Cove.

Quoyula monodonta (Q. & G.).

Purpura monodonta Quoy & Gaimard, Voy. 'Astrolabe,' Zool. II, p. 56, pl. xxxvii, f. 9-11, 1832.

Gorgona, not uncommon in colonies of *Pocillopora*.

Recorded by Tryon from the Indian Ocean, Japan and Central Pacific.

Family CYMATIIDÆ.

Cymatium (Turritriton) lineatum (Brod.).

Triton lineatus Broderip, P.Z.S. 1833, p. 6, 17/5/1833.

One dead shell at Tagus Cove, Albemarle Is.

A Galapagos species.

Distorsio constricta (Brod.).

Triton constrictus Broderip, P.Z.S. 1833, p. 5, 17/5/1833.

Gorgona, 15 f., living.

Monoplex brasilianus (Gould).

Triton brasilianus Gould, Pr. Boston Soc. N. Hist. III, p. 142, May 1849.

One dead, worn shell on Narborough Is.

Described from Rio Janeiro.

Bursa caelata (Brod.).

Ranella caelata Broderip, P.Z.S. 1832, p. 179, 14/1/1833.

Living at Panama.

Recorded down to Peru (Tschudi).

Family CASSIDIDÆ.

Cypræcassis tenuis (Wood).

Buccinum tenue Wood, Ind. Test. Suppl. p. 12, pl. iv. f. 4, 1828.

Dead shells, Indefatigable and Albemarle Is.

Confined to the Galapagos Is.

Cassidea abbreviata (Lam.).

Cassis abbreviata Lamarck, An. s. Vert. VII, p. 224, Aug. 1822.

Gorgona, one, young, alive.

Central American coast to Guayaquil.

Morum tuberculosum (Sow.).

Oniscia tuberculosa Sowerby, Gen. Rec. and Foss. Shells II, text to pl. 233.

Dead on Charles, Narborough and Indefatigable Is.

Family TONNIDÆ.

Ficus ventricosus (Sow.).

Pyrula ventricosa Sowerby, Tankerv. Cat. p. xvii, 1825.

One, small living, at Gorgona.

Malea ringens (Sw.).

Cassis ringens Swainson, Cat. Coll. Bligh, pp. 7, 25 and App. p. 4, 1822.

Dead shells on Coiba, Isla del Rey and Charles Is.

The I. del Rey shell is very prettily spotted.

Ranges also from Acapulco to Payta.

Family CYPRAEIDÆ.

Cypræa cervinetta Kiener.

Coq. Viv. p. 74, pl. vi, f. 1, 2, 1845.

Coiba, dead shells dredged in 10-12 f.

Ranges from Mazatlan to Peru and the Galapagos.

Cypræa nigropunctata Gray.

Zool. J. IV, p. 81, July 1828.

Taboga, dredged; dead shells picked up on Charles, Abemarle and Narborough Is.—those on the last-named were a small var., measuring 17 mm. in length.

Extends as far south as Chili (Hidalgo).

Cypræa robertsi Hidalgo.

Mon. Esp. Viv. Cypræa, p. 178, 1906.

Coiba, a dead shell.

Gulf of California to Payta (Dall).

Cypræa caput-serpentis L.

Syst. Nat. ed. 10, p. 720, 1758.

Several dredged living off Coiba Is.

This adds materially to its already recorded range: Hidalgo's list of localities is too long to quote, but it comprises S. and E. Africa, the whole Indian Ocean, Melanesia, Micronesia, Polynesia, New South Wales, Queensland.

Pustularia pustulata (Lam.).

Cypræa pustulata Lamarck, Ann. Mus. Paris XVI, p. 100, 1810.

Living on shore at Panama, and in colonies of *Pocillopora* on Gorgona.

Ranges from Mazatlan: Gorgona Is. appears to be the most southern loc. recorded.

Trivia maugeri (Gray).

Cypræa maugeri Gray, P.Z.S. 1832, p. 185, 14/1/1833.

Indefatigable Is., dead.

A rarity only known from the Galapagos.

Trivia pacifica (Gray).

Cypræa pacifica Gray, l.c.

Living on Cocos Is. and Charles Is.

Also known from Cape St. Lucas to Panama.

Trivia rubescens (Gray).

Cypræa rubescens Gray, l.c.

Narborough Is., dead shells.

Also known from Gulf of California to Panama.

Family AMPHIPERASIDÆ.

Amphiperas æquale (Sow.).

Ovulum æquale Sowerby, P.Z.S. 1832, p. 174, 14/1/1833.

Many dredged alive, Galapagos (island not specified).

Family STROMBIDÆ.

Strombus granulatus Wood.

Index Test. Suppl. p. 14, pl. iv, f. 21, 1828.

Jicaron Is.; Gorgona, common in all stages, dredged and on shore; Charles, James and Albemarle Is.; Coiba, on shore and in 10 f.—in all cases living.

Mazatlan to Guayaquil (Dall).

Strombus galea Wood.

l.c., f. 13, 1828.

Coiba, dead in 10 f. ; Gorgona, one young example dredged alive.

Recorded range, Mazatlan to Panama.

Strombus gracilior Sowerby.

Tankerv. Cat., App. p. xx, 1825.

Living on shore at Jicaron and Coiba Is.

Recorded range, Mazatlan to Manta.

Family CERITHIIDÆ.

Cerithium adustum Kiener.

Coq. Viv. p. 37, pl. xiii, f. 2, 1841.

Living on James, Charles, Indefatigable and Albemarle Is.

Cerithium uncinatum (Gmelin).*Murex uncinatus* Gmelin, Syst. Nat. ed. 13, p. 3542, 1791.

Taboga, dredged alive ; also living on shore at Jicaron, Coiba and Gorgona Is.

Vertagus gemmatus (Hinds).*Cerithium gemmatum* Hinds, Voy. Sulphur, Zool. p. 27, pl. xi, f. 5, 6, 1844.

Jicaron Is., dead : living at Coiba and Gorgona Is., at the latter on shore and in 15 fathoms.

The last three species are all endemic in the Panamic Province.

Cerithidea fortiuscula (Bayle).*Cerithium varicosum* Sowerby, Gen. Rec. Foss. Shells II, pt. 42, pl. ccxiii, f. 5, 1834, *non C. varicosum* Defr. 1817.*Cerithium fortiusculum* Bayle, J. de C. xxviii, p. 250, 1880.

Balboa, dead shells.

This may be the same as *montagnei* Orb.**Batillaria filosa** (Phil.).*Cerithium filosum* Philippi, Z. f. Malak., V, p. 143, March 1849.

Black Bight, Albemarle Is., living in a mangrove swamp.

Seila assimilata (C. B. Ad.).*Cerithium assimilatatum* C. B. Adams, Ann. Lyc. N. Hist. N. York V, p. 374, 1852.

Gorgona, dredged living.

Ranges from Catalina Is. to Sechura Bay, Peru (Dall).

Family MODULIDÆ.

Modulus duplicatus A. Adams.

P.Z.S. 1850, p. 204, 28/2/1851.

Taboga, dredged living ; James Is., living on shore and in 15 f ; Gorgona and Tagus Cove, Albemarle Is., living on shore.

Family PLANAXIDÆ.

Planaxis planicostatus Sowerby.

Tankerv. Cat., App. p. xiii, 1825.

Living on Cocos Is.

Ranges from Mazatlan to Peru and the Galapagos.

Family VERMETIDÆ.

Serpulorbis squamigerus (Cpr.).

Aletes squamigerus Carpenter, P.Z.S. 1856, p. 226, 26/1/1857.

Panama and Charles Is., living on shore; dead shells dredged off Coiba in 10 to 12 f., and on shore at Indefatigable Is.

Ranges from San Diego to Payta

Family TURRITELLIDÆ.

Turritella banksii Reeve.

Conch. Icon. V, pl. iv, f. 15, May 1849.

Balboa, dead on shore; Coiba, living on shore and in 10-12 f.

Turritella radula Kiener.

Coq. Viv. p. 13, pl. ii, f. 1, 1843.

Jicaron Is. and Isla del Rey, on shore; Coiba, dredged in 10-12 f.; Gorgona, very common in 15 f.; James Is., on shore—in all these cases living.

Turritella tigrina Kiener.

Coq. Viv. p. 29, pl. iv, f. 2, 1843.

Jicaron Is., dead on shore; Coiba Is., dead on shore and in 10 f.; Gorgona, alive.

All three species belong to the Panamic Province.

Family LITTORINIDÆ.

Littorina modesta Philippi.

P.Z.S. 1845, p. 141.

Common living on Cocos Is. These specimens tally exactly with those named *modesta* in the Brit. Mus. There seems to have been uncertainty as to the locality of the type lot.

Mazatlan (Menke).

Family ARCHITECTONICIDÆ.

Architectonica granulata (Lam.).

Solarium granulatum Lamarck, An. s. Vert. VII, p. 3, Aug. 1822.

Living on shore at Coiba and Gorgona.

Lower California to Peru (Dall).

Heliacus variegatus (Gmelin).

Trochus variegatus Gmelin, Syst. Nat. ed. xiii, p. 3575, 1791.

Coiba, living in 10 f.

A widespread species in the Pacific and Indian Oceans.

Family RISSOIDÆ.

Alvania galapagensis Bartsch (?).

Pr. U.S. Nat. Mus. XLI, p. 347, pl. xxx, f. 9, 15/11/1911.

Common in beach shingle from Indefatigable Is., but all the specimens are so worn that it is impossible to identify them with any certainty.

Rissoina inca Orbigny.

Voy. Am. Mérid. V, p. 395, pl. liii, f. 11-16, 1840.

Dredged living in 15 f. at Gorgona and in 17 f. at James Is.; living at Tagus Cove; dead shells in shingle from Charles, Narborough and Indefatigable Is.

Known from the mainland from Peru to the Island of Chiloe.

Family HIPPONICIDÆ.

Hipponix barbatus (Sow.).

Hipponyx barbata Sowerby, P.Z.S. 1835, p. 5, 3/4/1835.

Dead shells from Gorgona, Narborough, James and Indefatigable Is.; living on Charles Is.

Ranges from Mazatlan to Guayaquil, and is also Indo-Pacific (Dall).

Family CALYPTRAÆIDÆ.

Calyptraea mammillaris Broderip.

Tr. Zool. Soc. I, pt. iii, p. 201, pl. xxviii, f. 5, Apl. 1835.

Gorgona, dead only.

Ranges from Mazatlan to Payta.

Cheilea cepacea (Brod.).

Calyptraea cepacea Broderip, P.Z.S. 1834, p. 35, 29/7/1834.

Charles Is., living; Indefatigable Is., dead in shingle.

Described from Muerte Is.

Crucibulum imbricatum (Sow.).

Calyptraea imbricata Sowerby, Gén. Rec. Foss. Shells, pl. cli, f. 5, 1824.

Living at Tagus Cove on shore, and in 17 f. off James Is.

Ranges from the Gulf of California to Callao.

Neleta serrata (Brod.).

Calyptraea serrata Broderip, Tr. Zool. Soc. I, pt. iii, p. 200, pl. xxviii, f. 1, Apl. 1835.

Coiba, dredged alive.

Described from Real Llejos and Muerte Is.

Family CREPIDULIDÆ.

Crepidula aculeata (Gmelin).

Patella aculeata Gmelin, Syst. Nat. ed. xiii, p. 3693, 1791.

Charles, Indefatigable and Albemarle Is., dead.

A cosmopolitan species, occurring from California to Peru, in the West Indies, South Africa, Japan, Indian Ocean and Polynesia.

Crepidula incurva (Brod.).

Calyptraea incurva Broderip, P.Z.S. 1834, p. 40, 29/7/1834.

Living at Tagus Cove, Albemarle Is. and in 17 f., James Is.

Ranges from Mazatlan to Payta.

Family NATICIDÆ.

Natica pritchardi Forbes.

Ann. Mag. N.H. X, p. 307, Oct. 1852.

One living on Gorgona Is.

Polinices glabella (Reeve).

Natica glabella Reeve, Conch. Icon. IX, pl. xxvii, f. 124, June 1855.

Living at Cocos Is. and Indefatigable I.; James Is., dead.

Described from unknown habitat.

Mamilla macrostoma (Phil.).

Natica macrostoma Philippi, Syst. Conch. Cab., Lief. 108, p. 55, pl. ix, f. 1, 1852.

One dead shell from Charles Is., somewhat worn but I think certainly *macrostoma*, which was described from unknown habitat.

Family JANTHINIDÆ.

Janthina janthina (L.).

Helix janthina L., Syst. Nat. ed. 10, p. 772, 1758.

Washed up on Gorgona.

Dall gives N. Lat. 42° to S. Lat. 36° as the range of this species.

Family EPITONIIDÆ.

Epitonium diadema (Sow.).

Scalaria diadema Sowerby, P.Z.S. 1832, p. 55, 5/6/1832.

Tagus Cove, Albemarle Is., two dead.

A Galapagos species.

Epitonium replicatum (Sow.).

Scalaria replicata Sowerby, P.Z.S. 1844, p. 11, July 1844.

Gorgona, one broken shell dredged.

A Polynesian species.

Family NERITIDÆ.

Nerita scabricosta Lamarck.

An. s. Vert. VI (2), p. 194, Apl. 1822.

Living, Isla del Rey and Gorgona, common.

Neritina (Neripteron) latissima (Brod.).

Neritina latissima Broderip, P.Z.S. 1832, p. 200, 13/3/1833.

Living on Coiba and Gorgona.

[To be continued].

THE MOLLUSCA OF LAKE ALBERT NYANZA.

By M. CONNOLLY.

(Read before the Society, May 7th, 1927).

THE only comprehensive work on the fresh-water mollusca of Lake Albert Nyanza is that of E. A. Smith¹ who recorded from it in 1888 the following fifteen species, of which five were supposed to be new to science:—*Planorbis sudanicus* Mts. and *stanleyi* Smith, *Ampullaria wernei* Phil., *Paludina unicolor* Oliv. (var.), *Cleopatra emini* Smith, *Bythinia alberti* and *walleri* Smith, *Melania tuberculata* Müll. and *liricincta* Smith, *Unio ægyptiacus* Caill., *caillaudi* Fér., *bakeri* and *acuminatus* H. Adams, *Corbicula radiata* and *pusilla* Philippi.

Since that date von Martens² and Germain³ have published slight emendations of Smith's list and Cox⁴ has broken entirely fresh ground of the most absorbing interest by describing a collection of fossils, of which at least five are new to science, made by E. J. Wayland at Kaiso, near the eastern shore of the lake; while, subsequent to the reading of the present paper, there has appeared the magnificent work of Pilsbry and Bequært⁵ on the aquatic Mollusca of the Belgian Congo, in which will be found full geographical references to all the recent species known to have been collected in Lake Albert.

It might therefore seem that anything further on this subject would be superfluous at the present juncture, but as a matter of fact, during the last three years Mr. and Mrs. A. O. Fisher and Captain C. R. S. Pitman have sent home collections which add to this fauna several fresh inhabitants, in addition to increasing our knowledge of the older, so that the following paper may be acceptable as a sequel to Smith's earlier work. It will be noted that two of his original fifteen species have to be eliminated from the present list, while only nine of the remainder retain the names under which he listed them.

As none of the fossils have so far been identified as still living in the lake, I propose to deal with the two sections separately. No references to literature are given unless they have some important bearing on the present study. I include in the body of my list all species which have rightly or wrongly been recorded from the lake, and have adopted without question, save in one or two cases, the nomenclature employed by Pilsbry and Bequært.

¹ P.Z.S., 1888, pp. 52-56.

² Deutsch Ost Africa, iv, 1897, pp. 289-294.

³ Arch. Zool. Expér., iv, 1907, pp. 124-127 and Voy. Babault, 1920, pp. 52-55.

⁴ The Geology and Palæontology of the Kaiso Bone-Beds (Government Press, Uganda 1926, pp. 53-71).

⁵ Bull. Amer. Mus. Nat. Hist., liii, 1927.

(a) RECENT SPECIES.

Family PLANORBIDÆ.

Genus **Planorbis** Geoff.**Planorbis sudanicus** Mts.

- 1870 *Planorbis sudanicus* Mts., Mal. Blätt., xvii, p. 35.
 1888 do do do, Smith, P.Z.S., p. 55.
 1897 do do var. *major*, Mts., D.O.A., iv, p. 146.
 1927 do do *tanganikanus* Bgt., P. & B., Bull. Amer. Mus. N.H., liii, p. 122.

Hab. Lake Albert (Emin; Baker); Toro District, South shore of lake (Fisher); Ndandamira (Pitman).

Judging from such specimens as I have seen, I am inclined to agree with the nomenclature adopted above by Pilsbry and Bequaert.

Planorbis gibbonsi Nels.

- 1878 *Planorbis gibbonsi* Nels., Q. J. of C., i, p. 379; pl. iv, f. 3.
 1897 do do do Mts., D.O.A., iv, p. 150.
 1927 do (*Gyraulus*) do do P. & B., Bull. Amer. Mus. N.H., liii, p. 126.

Hab. Lake Albert. Kassenje (Stuhlmann); Toro Dist. (Fisher).

Originally described from Zanzibar, there has long existed a little doubt about this species, owing to the figure not agreeing with the description; having recently examined specimens from Zanzibar, presumably topotypes, I can confirm their agreement with the form which is now universally accepted under the above name, and which is so widely diffused from Abyssinia to Cape Town.

Planorbis adowensis Bgt.

- 1879 *Planorbis adowensis* Bgt., Descr. div. Moll. &c., p. 11.
 1897 do do do Mts., D.O.A., iv, p. 147.

Hab. Lake Albert. Ndandamira; Butiaba (Pitman).

In recording this species from Lake Albert, von Martens rather doubtfully placed *Plan. stanleyi* Smith in its synonymy, and I think that he had in view examples of Smith's species, rather than that of Bourguignat. It is probably due to this record that Germain listed *adowensis*, omitting all mention of *stanleyi*, and that P. and B. follow the synonymy suggested by von Martens, but it is doubtful whether the true *adowensis* has previously been recorded from the lake.

The collections now under review contain two forms of a rather small shell of the *sudanicus* group; in one, the aperture remains about the same altitude as the last whorl, so that the shell is comparatively low, while in the other the aperture expands rapidly, so that the shell increases rapidly in altitude, this being the typical *stanleyi* Smith. In

order to elucidate the question of synonymy, I submitted some examples of each form to Dr. Germain, who kindly reported on the former as follows:—"The six examples of a form less thick (less in altitude) belong to the forma *minor* of *Planorbis adowensis* Bgt. However, in East Africa the two species" (*adowensis* and the form sent him as *stanleyi*), "present allied forms, more or less intermediate and often easy to mistake."

Planorbis stanleyi Smith.

(=**bridouxianus** Bgt.)

June, 1888 *Planorbis stanleyi* Smith, P.Z.S., p. 35.

Nov., do do *bridouxianus* Bgt., Icon. Mal. Tanganika, pl. i, f. 9-12.

Hab. Lake Albert (Emin); Kassenje (Schubotz); Toro District (Fisher); Butiaba; Ndandamira (Pitman).

Germain's report is as follows:—"The four specimens named *Planorbis stanleyi* Smith are very certainly *Planorbis bridouxi* Bourgt. I have compared them with the type of J. R. B., which is here, and there can be no doubt about the matter. If your specimens are really *Pl. stanleyi*, the two species are evidently synonyms."

The type of *stanleyi* being in the British Museum, there can be no question as to the correct identification of the species, and that *bridouxianus* Bgt. must fall into its synonymy; but whether it is really specifically distinct from *adowensis* appears a little doubtful, although the typical forms are easily distinguishable. It is worth placing on record that an immature example of this species, collected by Mrs. Fisher in the Tororo District, on the north shore of Lake Victoria Nyanza, has similar apertural dentition to that of *Plan. alexandrinus* etc., but I have failed to find this peculiarity in a large number of other young shells that I have examined.

Planorbis chudeaui Germ. (?)

1907 *Planorbis chudeaui* Germ., Bull. Mus. Paris, p. 274; text figure 23.

Hab. Lake Albert. Ndandamira (Pitman).

In his description of this species Germain states that its last whorl presents two very pronounced angulosities, one above and the other at the base, which give to it in profile a very sharp rectangular appearance. Pitman's specimens are extremely small, hardly a third as large as Germain's type, and do not agree in all respects with other details of his figure and description, but they may be very immature, and as they present the extraordinary feature stressed by him of the double angulation, I do not venture to separate them from his species unless

further material may prove them distinct. The circumference of the last whorl, in profile, is practically flat between the two rectangular carinæ, from which points it inclines inwards towards the apex and base.

Genus **Bulinus** Müll.

(=**Isidora** Ehrn.)

Bulinus strigosus (Mts.)

1897 *Isidora strigosa* Mts., D.O.A., iv, p. 139; pl. vi, f. 11.

Hab. Lake Albert. Butiaba (Pitman).

The first record of this genus from Lake Albert.

Family PILIDÆ.

Genus **Pila** Bolten.

Pila stuhlmanni (Mts.)

1888 *Ampullaria wernei* Phil., Smith, P.Z.S., p. 53.

1897 do *erythrostroma* Rve., var. *stuhlmanni* Mts., D.O.A., iv, p. 155.

1927 *Pila stuhlmanni* Mts., P. & B., Bull. Amer. Mus. N.H., liii, p. 182

Hab. Lake Albert (Baker, two young shells); Kassenje (Stuhlmann); Butiaba; Ndandamira (Pitman).

All the specimens I have seen appear to be conspecific, and I follow Pilsbry in their designation; the largest shell collected by Pitman measures 96×84 mm. in its last $1\frac{1}{2}$ whorls, the earlier being deficient.

Family VIVIPARIDÆ.

Genus **Viviparus** Montf.

Viviparus rubicundus (Mts.).

1879 *Paludina rubicunda* Mts., Sitz.-Ber. Ges. Nat. Fr., Berlin, p. 104.

1888 do *unicolor* Oliv., var., Smith, P.Z.S., p. 53.

1897 *Vivipara rubicunda* Mts., D.O.A., iv, p. 179.

Hab. Lake Albert (Baker; Emin; Gordon); Kassenje (Schubotz); Toro District (Fisher); Butiaba; Ndandamira (Pitman).

Remarkable for its very rounded whorls, but very variable in form and colour, which may be red, brown, green or yellow.

Family AMNICOLIDÆ.

Genus **Bulimus** Scop.

(=**Bithynia** Leach).

Bulimus alberti (Smith).

1888 *Bythinia alberti* Smith, P.Z.S., p. 54.

Hab. Lake Albert (Emin); Kassenje (Emin and Stuhlmann); Toro Dist. (Fisher); Butiaba; Ndandamira (Pitman).

Bulimus tilhoi (Germ.).

1912 *Bythinia tilhoi* Germ., Bull. Mus. Paris, xviii, p. 322.

1916 do do do Doc. Sci. Miss. Tilho, iii, p. 306; pl i, f. 5-6.

Hab. Lake Albert. Toro Dist. (Fisher); Butiaba; Ndandamira (Pitman).

A much smaller form than *alberti* or *walleri*, agreeing well with Germain's description of *tilhoi*, which was originally described from Bengu, Niger Territory.

Bulimus walleri (Smith).

1888 *Bythinia walleri* Smith, P.Z.S., pp. 54, 55, f. 3.

Hab. Lake Albert (Emin); Toro Dist. (Fisher); Butiaba; Ndandamira (Pitman).

Founded on a single specimen, which is not in the British Museum, it is satisfactory to have re-established this species, which is easily recognisable from Smith's figure. Examples of the typical form, collected by Pitman, are rather more mature than the type, exceeding it by nearly a millimetre in altitude, while a few still longer specimens, with much exserted spire, deep suture and very convex whorls, approach very closely the figure of *B. martreti* (Germain), (L'Afr. Centrale Franç., 1907, pl. v, f. 12).

Family THIARIDÆ.

Genus **Melanoides** Oliv.**Melanoides tuberculatus** (Müll.).

1774 *Nerita tuberculata* Müll., Verm., ii, p. 191.

Hab. Lake Albert (Emin); Kassenje (Stuhlmann); Toro District (Fisher); Butiaba; Ndandamira (Pitman).

I refrain from giving further references to this well known species; the race inhabiting Lake Albert is an extremely small and slender one.

Genus **Potadoma** Swains.**Potadoma liricincta** (Smith).

1888 *Melania liricincta* Smith, P.Z.S., pp. 52, 53, f. 1.

1897 do do do Mts., D.O.A., iv, p. 195.

1927 *Potadoma* do do P. & B. Bull. Amer. Mus. N.H., liii, p. 280.

Described as from Lake Albert (Emin), but von Martens states that he was unable to find this species in the material collected in the lake by Emin and Stuhlmann, while Pilsbry and Bequaert suggest that the type was picked up some distance to the west or south-west of the lake, and can be removed from its fauna.

Potadoma tornata (Mts.).1892 *Melania tornata* Mts., Sitz.-Ber. Ges. Nat. Fr., Berlin, p. 181.

Germain includes this species in his 1920 list for Lake Albert, but I can find no record of its having been collected there, the localities in which it occurs all appearing to be considerably to the westward.

Genus **Cleopatra** Trosch.**Cleopatra pirothi** Jick.(=**emini** Smith).1881 *Cleopatra pirothi* Jick., Jahrb. D. Mal. Ges., p. 338.1888 do *emini* Smith, P.Z.S., p. 54, f. 2.1897 do *pirothi* Jick., (= *emini* Smith), Mts., D.O.A., iv, p. 185.

Hab. Lake Albert (Emin); Kassenje (Stuhlmann); Toro Dist. (Fisher); Butiaba; Ndandamira (Pitman).

The representation includes varieties with one, two or three carinae, but I have not yet seen one from the lake with more than three; such, however, do not seem common.

Cleopatra guillemei Bgt.1885 *Cleopatra guillemei* Bgt., Esp. Nouv. Ouker. Tanganika, p. 6.

This species is included in Germain's list of 1920, but I can find no authentic record of its collection in Lake Albert; possibly its occurrence there is based on water-worn examples of *pirothi*, which presents a very different appearance when it is in recent condition, covered with a blackish epidermis, to that of dead shells, which are smooth and glossy, with many gay patterns of vari-coloured spiral banding.

Family UNIONIDÆ.

Genus **Parreysia** Conrad.**Parreysia acuminata** (H. Ad.).1866 *Unio acuminatus* H. Ad., P.Z.S., p. 376.

Hab. Lake Albert (Baker); Kassenje (Stuhlmann; Schubotz); Ndandamira (Pitman); Butiaba (Mearns).

An easily recognisable species, greatly resembling *teretiuscula* Phil.; it appears to be comparatively infrequent.

Parreysia bakeri (H. Ad.).1866 *Unio bakeri* H. Ad., P.Z.S., p. 376.

Hab. Lake Albert (Baker; Emin); Kassenje (Stuhlmann; Schubotz); Toro District (Fisher); Butiaba; Ndandamira (Pitman).

Parreysia teretiuscula (Phil.).

1838 *Margarita (Unio) cailliaudi* Fér., Lea, Syn. Naiades, p. 24 (nomen nudum).

- 1847 *Unio teretiusculus* Phil., Abb. u. Besch., iii, p. 45, pl. iii, f. 3.
 1866 do *caillaudi* Fér., Mts., Mal. Blätt., p. 13.
 1866 do do do H. Ad., P.Z.S., p. 376.
 1888 do do do Smith, do p. 56.
 1897 do *teretiusculus* Phil., Mts., D.O.A., iv, p. 229.

Lea's reference being merely nomen nudum, the name awarded by Philippi is correct for this common Nilotic species, but I do not believe that the two bleached valves, on which the record is based, were collected in Lake Albert. They were originally labelled as from the Upper Nile, and are of extremely low altitude, measuring $36\frac{1}{2} \times 15$ and 35×14 mm. respectively, thus being exaggerated examples of the var. *pallaryi* Longstaff, and as nothing approaching this form has since been collected in or near the lake, it is probable that they were actually picked up a considerable distance to the north of it.

Genus **Cælatura** Conrad.

Cælatura egyptiaca (Caill.).

- 1823 *Unio egyptiacus* Caill., Voy. à Meroe, Atlas, ii, pl. lxi, f. 6-7.
 1827 do *ægyptiacus* do do do do iv, p. 263.

Hab. Lake Albert (Baker); Kassenje (Schubotz); Toro Dist. (Fisher); Ndandamira (Pitman).

Examples attributable to this species vary greatly, some appearing to grade into *bakeri* Ad., which can hardly belong to a different genus; *egyptiacus* and *niloticus* Caill., of which the former has priority, must be very near akin, and are inextricable from one another in most collections.

Family MUTELIDÆ.

Genus **Aspatharia** Bgt.

Aspatharia stuhlmanni (Mts.).

- 1900 *Spatha stuhlmanni* Mts., Simpson, Proc. U.S. Nat. Mus., xxii, p. 900.
 1927 *Aspatharia* do do P. & B., Bull. Amer. Mus. N.H., liii, p. 419.

Recorded by Simpson from Lake Albert, and subsequently by Germain, probably on the former's authority; P. & B. point out that Simpson's locality was erroneous, this mussel having been originally described from the Ituri District, west of the lake.

Genus **Mutela** Scop.

Mutela emini Mts.

- 1897 *Mutela nilotica* Caill., var. *emini* Mts., D.O.A., iv, p. 253.
 1927 do *emini* Mts., P. & B., Bull. Amer. Mus. N.H., liii, p. 435; pl. xlii, f. 2.

Hab. Lake Albert; Kassenje (Stuhlmann and probably Schubotz); Toro District (Fisher); Butiaba; Ndandamira (Pitman).

From examination of specimens from the Fisher and Pitman collections, I certainly concur with P. & B. in awarding this race full specific rank ; it is far more inequilateral than *nilotica*.

***Mutela alluaudi* Germ.**

1909 *Mutela alluaudi* Germ., Bull. Mus. Paris, p. 544 ; pl. viii, f. 45.

Hab. Lake Albert (Alluaud) ; Toro District (Fisher).

The solitary example collected by Mrs. Fisher agrees with the original description and figure in all respects except that while its altitude is the same as the type, its length is about 6 mm. less.

Germain described this species from Lake Albert, but omitted it from his faunal list of 1920 ; it appears to be a valid species, and its re-discovery confirms the locality ; it is proportionately of greater altitude than *emini*, and more regularly rhombic.

Family CYRENIDÆ.

Genus ***Corbicula*** Muhl.

***Corbicula pusilla* 'Parr.' (Phil.).**

1846 *Cyrena pusilla* Parr., Phil., Abb. u. Beschr., ii, p. 78 ; pl. i, f. 7.

1866 *Corbicula* do Phil., H. Ad., P.Z.S., p. 376.

***Corbicula radiata* 'Parr.' (Phil.).**

1846 *Cyrena radiata* Parr., Phil., Abb. u. Beschr., ii, p. 78 ; pl. i, f. 8.

1866 *Corbicula* do Phil., H. Ad., P.Z.S., p. 376.

1927 do do do P. & B., Bull. Amer. Mus. N.H., liii, p. 341.

***Corbicula radiata edwardi* P. & B.**

1927 *Corbicula radiata edwardi* P. & B., Bull. Amer. Mus. N.H., liii, p. 343 ; text fig. 73 (described from L. Albert Edward).

As almost every intermediate occurs, I do not attempt to discriminate between the above forms ; the localities are

Lake Albert (Baker ; Emin ; Schubotz) ; Kassenje (Stuhlmann) ; Kiboro (in British Museum) ; Toro Dist. (Fisher) ; Butiaba and Ndandamira (Pitman).

The series from the last two stations embraces nearly every conceivable admixture of sculpture and coloration, from almost smooth and glossy growth wrinkles to close, sharp, concentric striation, while the colour, quite independently of the sculpture, is dark green, shading to grey at the umbones or with a pale yellow marginal girdle ; pale green, bluish grey, brown, bright yellow, flesh white, sometimes with a single lilac ray, when it is extremely delicate and beautiful, and finally combining with many of the foregoing the typical radiate umbones of *radiata*. The interior is impartially dark grey, pale yellow, or vari-coloured, occasionally corresponding exactly to the rayed exterior.

As pointed out by the present writer in 1925 and by P. & B. (l.c.) the name *radiata* of Philippi is preoccupied and cannot be retained, but it is difficult to determine without doubt by what name it should be replaced. *Pusilla* was bestowed on a race of very pale yellow shells from the Upper Nile, of which there is a set from Assouan in the British Museum, received from Parreyss; they are remarkable for their extremely weak sculpture, and accordingly glossy appearance, and I do not think it possible that, as has been suggested by Pallary, they could ever develop into the large, coarsely sculptured *consobrina* Caill.

On the other hand, the sculpture of typical *radiata*, consisting of close, regular, clean cut concentric costulæ, resembles very nearly that of *consobrina* in its earlier stage of growth, and they may possibly be conspecific, but if so, it is strange that nowhere else throughout Africa does *radiata* attain more than half the dimensions of the large Nilotic *consobrina*; whether it would do so under Nilotic conditions can only be proved by experiment.

Consobrina is, of course, the oldest name in this group; *pusilla* has page precedence over *radiata*, while if all the three are distinct, *africana* Krs., 1848, is available to replace *radiata* Phil.

Family SPHÆRIIDÆ.

Genus **Sphærium** Scop.

Sphærium nyanzæ Smith.

1892 *Sphærium nyanzæ* Smith, A.M.N.H., x, p. 383.

Hab. Lake Albert (Schubotz); Toro Dist. (Fisher); Butiaba; Ndandamira (Pitman).

Genus **Eupera** Bgt.

Eupera parasitica 'Parr.' (Desh.).

1854 *Pisum parasiticum* Parr., Desh., Cat. Conchif., p. 280.

Hab. Lake Albert; Toro Dist. (Fisher); Butiaba; Ndandamira (Pitman).

As P. & B. (l.c. p. 357) mention that the dimensions of the type of this species have never been published, I may state that its measurements are: long., 5.2; lat., 3.6; diam. circa 2.8 mm.

The specimen most nearly approximating to it in size from Lake Albert is 5.6 × 3.9 mm. in length and altitude.

With a good representation of *E. ferruginea* (Krs.) before me for comparison, I agree with Smith that the North African *parasitica* is quite distinct from the South African *ferruginea*, but it appears doubtful whether the other Nilotic and Abyssinian forms, described by Bourguignat and his disciples, are separable from that of Deshayes.

[To be concluded].

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND.

556th Meeting, held at the Manchester Museum, May 7th, 1927.

Mr. G. C. Spence in the chair.

Additions to the Library.

Reprints of papers by Dr. Paul Bartsch and Mr. H. Schlesch (from the authors).

Resignation.

Arthur F. Gray.

Honorary Member Deceased.

Professor G. O. Sars.

Paper Read.

"The Mollusca of Lake Albert Nyanza," by Major M. Connolly.

Exhibits.

By Mr. E. R. Brown: Series of *Olivancillaria*.

By Mr. G. C. Spence: *Dorcasia*.

By Mr. C. H. Moore: Series of *Conus*.

By Mrs. Gill: *Euhadra* group; also *Cymbium proboscoidale* and *porcinum*.

The special exhibit was *Xesta*.

557th Meeting, held at the Manchester Museum, September 10th, 1927.

Mr. G. C. Spence in the chair.

Additions to the Library.

Large collection of Sir Chas. Eliot's papers on Nudibranchs (presented by Mr. Guy L. Wilkins).

"The Aquatic Molluscs of the Belgian Congo, with a Geographical and Ecological Account of Congo Malacology," by H. A. Pilsbry and J. Bequaert (presented by the American Museum of Natural History).

Reprints of papers by Drs. W. H. Dall, Paul Bartsch, Messrs. W. B. Marshall, H. Schlesch, A. S. Kennard and B. B. Woodward.

Donations to Cabinet.

Seventy-three species of marine shells collected on the shore at Abersoch, Carnarvonshire, in 1900, from Mrs. Gill.

Planorbis vorticulus from Amberley, W. Sussex, and Caddis-cases composed of shells including *P. vorticulus* from Lewes, from Mr. A. E. Ellis.

Collection of autographs and numerous shells, from Mr. H. Schlesch.

Maps showing the loci of *Clausilia bidentata* at Portmadoc (see Journal, xvi. 10; xviii, 131) from Dr. A. E. Boycott.

Portrait of himself taken in 1925, and a large number of shells, from Mr. John Brazier.

Punctum pygmaeum var. *albina* from Aston Clinton, Bucks.; *Margaritana margaritifera* from Eastern Cleddau, Llawhaden, Pembrokeshire; *Anodonta anatina* from River of Wick, Caithness; and remarkably large *Limnæa truncatula*, from Ackergill Links, near Wick, Caithness, from Mr. C. Oldham.

Candidate Proposed for Membership.

Ernest St. John Burton, F.L.S., F.G.S., F.Z.S., Melville, 4, Howard Road, Bournemouth (introduced by Duncan Keogh and James E. Cooper).

Resignations.

Miss M. C. Moore, Julius Heller, Col. F. S. Bowring.

Members Deceased.

Dr. W. H. Dall (Hon. Member) ; Marchese di Monterosato (Hon. Member) ; J. B. Henderson, jr. ; James Gibson.

Papers Read.

- " *Margaritana margaritifera* in Pembrokeshire," by C. Oldham.
- " *Punctum pygmaeum* v. *albina* in Britain," by C. Oldham.
- " *Paludestrina jenkinsi* in Orkney and Caithness," by C. Oldham.
- " Range in Pembrokeshire of *Euparypha pisana*," by C. Oldham.
- " *Littorina rudis* v. *tenebrosa* Mont.," by J. E. Cooper.
- " *Vertigo moulinsiana* (Dupuy) near Norwich," by A. E. Ellis.
- " Notes on the Land Mollusca of the Llandudno District," by W. E. Alkins.
- " Non-Marine Mollusca from West Africa," by G. C. Spence.

Exhibits.

- By Mr. C. Oldham : Specimens to illustrate his papers.
- By Mr. G. C. Spence : Specimens to illustrate his paper.
- By Mr. A. K. Lawson : Varieties of *Nucella lapillus* (L.).
- By Mr. H. Schlesch : A number of species from the " Russell Collection."

558th (Annual) Meeting, held at the Manchester Museum, October 1st, 1927.

The President, Mr. Hugh Watson, M.A., in the chair.

Amongst those present were the following :—Messrs. Fred Taylor, B. R. Lucas, R. Harrison, G. C. Spence, J. D. Dean, H. de W. Marriott, A. K. Lawson, C. H. Moore, Chas. Oldham, J. Wilfrid Jackson, Dr. A. E. Boycott, Mr. and Mrs. Gill, Mr. T. A. Coward, and Professor J. S. Dunkerly.

Appointment of Scrutineers.

Messrs. Fred Taylor and H. de W. Marriott were appointed Scrutineers.

Appointment of Auditors.

Messrs. C. H. Moore and Fred Taylor were appointed Auditors.

New Member Elected.

Ernest St. John Burton.

Candidate Proposed for Membership.

Cyril Ingram Paton, Streatham College, Streatham Common, London, S.W. 16 (introduced by C. Oldham and J. W. Jackson).

Presidential Address.

The President delivered an address on " The affinities of *Cecilioides* and *Ferussacia*, illustrating adaptive evolution."

A cordial vote of thanks was passed to the retiring President for his admirable address.

A vote of thanks was also accorded to the Authorities of the Manchester Museum for the use of rooms and light for the Annual Meeting and the monthly meetings of the Society.

Election of Officers and Council.

The Scrutineers reported that the Officers and Council for 1927-28, as nominated, had been unanimously elected.

Exhibits.

By Mr. C. I. Paton : *Anodonta anatina* from the river Lhen, parish of Andreas, Isle-of-Man.

By Mr. C. Oldham : *Neritina fluviatilis*, from Loch of Stennes, Orkney (not known elsewhere north of Westmorland) ; *Planorbis corneus* (parents and offspring) with white shells and red animals.

By Dr. A. E. Boycott and Mr. C. Oldham : Abnormal growth of *Helix aspersa* occurring in "epidemic," from Nevin, Carnarvonshire.

By Mr. J. W. Jackson : *Neritina fluviatilis* and *Ceciloides acicula* from many localities.

By Mr. G. C. Spence : Various African shells.

By Mr. Fred Taylor : *Helix pomatia* (adults and juveniles) including a living sinistral specimen, from chalk-pits, Coulsdon, Surrey, 1927.

By Mrs. Gill : *Oliva porphyria*, *O. erythrostoma*, *O. angulata*, *O. textilina*, *O. ponderosa*, and many of the smaller species.

By Mr. C. H. Moore : Series of the smaller land shells from Grange-over-Sands and Arnside.

By the Rev. L. W. Grensted : A dead example of *Vitrea lucida* from débris of R. Alt, South Lancashire.

By Mrs. A. Anderson : A remarkably fine specimen of *Cypræa arabica*, obtained in Fiji in 1926 ; also *Cypræa reticulata* v. *intermedia*.

ANNUAL REPORT.

THIS is the 51st Annual Report of the Society. Since the last Annual Meeting the Society has lost seven members by death (including three Honorary Members), eight by resignation, and two have been struck off the roll in accordance with Rule iv, making a total loss of seventeen. Five new members have been elected, and the membership to-day is 247 (as against 259 in October, 1926).

The losses by death are :—J. Darker Butterell, Percy T. Deakin, Professor G. O. Sars, Dr. W. H. Dall, Marchese di Monterosato, James Gibson, and J. B. Henderson, Jr.

Eight monthly meetings have been held at the Manchester Museum (by the kind permission of the Authorities). Twenty-two notes and papers have been read and some of these have appeared in the Journal. The special exhibits have been *Physa*, *Diplommatina*, *Cerion*, *Trivia*, *Cleopatra*, and *Xesta*.

Since the Annual Meeting in October last three numbers of the Journal have been issued : vol. 18, No. 3, January, 1927 ; vol. 18, No. 4, March, 1927 ; and vol. 18, No. 5, June, 1927, comprising 88 pages of text and 84 text-figures.

The Library has been augmented by additions from Drs. Paul Bartsch, W. H. Dall, J. H. Orton, J. Cosmo Melvill, and Paul Pelseneer, Messrs. W. B. Marshall, A. S. Kennard, B. B. Woodward, H. Schlesch, G. C. Spence, J. W. Jackson, A. E. Salisbury, Miss A. L. Massy, Miss R. A. Barr and the American Museum of Natural History. The additions also include a large collection of papers and memoirs, several by Dr. R. Sturany, received in exchange for back numbers of the Journal of Conchology from the Natural History Museum of Vienna ; and a large collection of Sir Chas. Eliot's papers on Nudibranchs from Mr. Guy L. Wilkins.

Donations to the Cabinet have been received from Messrs. H. Schlesch, A. E. Ellis, J. Brazier, C. Oldham, Dr. A. E. Boycott, and Mrs. Gill.

RECORDER'S REPORT (Non-Marine Mollusca).

SINCE the last report (vol. xviii, p. 82) the following new records, 40 in number, have been authenticated for the Census :—

Cornwall W. (1) :—*Vertigo antivertigo* (G. D. H. Carpenter),

Somerset S. (5) :—*Pisidium henslowanum* (C. Oldham),

Dorset (9):—*Pisidium personatum* (W. D. Lang).

Isle of Wight (10):—*Arion minimus* (L. E. Adams).

Hants N. (12):—*Pisidium hibernicum* (C. Oldham).

Sussex W. (13):—*Planorbis vorticulus* (Amberley: A. E. Ellis).

Sussex E. (14):—*Acme lineata* (Rushlake: G. Shrubsole), *Succinea oblonga* (Winchelsea: J. R. Tomlin).

Suffolk E. (25):—*Planorbis glaber* (Aldeburgh: J. E. Cooper).

Pembroke (45):—*Limax cinereoniger* (C. Oldham).

Yorks. S.W. (63):—*Planorbis dilatatus* (Oldham: F. Taylor).

Aberdeen S. (92):—*Pisidium hibernicum* (C. Oldham).

Easternness (96):—*Valvata piscinalis*, *Pisidium casertanum*, *P. hibernicum*, *P. milium*, *P. nitidum*, *P. obtusale*, *P. subtruncatum* (C. Oldham).

Sutherland E. (107):—*Vallonia excentrica*, *Paludestrina stagnalis*, *Pisidium casertanum* (C. Oldham).

Caithness (109):—*Arion minimus*, *Succinea putris*, *S. elegans*, *Helicella caperata*, *Ancylus fluviatilis*, *Limnæa palustris*, *Planorbis spirorbis*, *Pl. glaber* (L. Scarmclate), *Pl. nautilus*, *Valvata piscinalis*, *Paludestrina jenkinsi*, *Pisidium casertanum*, *P. henslowianum*, *P. hibernicum*, *P. lilljeborgi*, *P. nitidum*, *P. subtruncatum* (C. Oldham).

Orkney (111):—*Paludestrina jenkinsi* (C. Oldham).

REPORT OF THE LONDON BRANCH, October 1st, 1927.

This Branch has held ten Evening meetings at which the attendance has been very good owing to increased membership.

The exhibits have been of great interest, as, apart from the shells shown by our members, we have had again assistance, with rare varieties, from Mr. J. R. le B. Tomlin and from Major M. Connolly.

A record I think was established when among the rare Volutes shown by Mr. Arthur Blok, Mr. J. E. Cooper and Mr. J. R. le B. Tomlin there were two specimens each of *Mamillana roadnightæ* (McCoy) and *Psephæa prevostiana* (Crosse).

Interesting Notes on the species shown were given by our President (Mr. A. S. Kennard, A.L.S.), Col. A. J. Peile, Mr. J. E. Cooper and Mr. Jas. Wintle.

Two afternoon Field Outings were also held.—J. C. DACIE (*Hon. Sec.*).

ANNUAL REPORT OF THE YORKSHIRE BRANCH.

Eleven meetings were arranged for the Session, four of which were excursions during the summer months. A good attendance prevailed at all Meetings held so far; the November and the Annual Meetings of the Branch are yet to take place. The last Annual Meeting was held in Leeds on December 11th, 1926 and the following were elected to office:—President, Mr. T. W. Saunders, F.G.S. (Doncaster); Vice-Presidents, Mr. J. Greevz Fysher and Mr. H. Sowden; Hon. Secretary, Mr. John R. Dibb; Hon. Treasurer, Mr. H. J. Armstrong.

MEETINGS:—At the first meeting of the Session was a lecture by Mr. J. A. Hargreaves (Leeds) entitled "Some Yorkshire Marine Molluscs." The large attendance of members proved the popularity of the lecturer. At the February meeting Mr. H. Sowden (York) lectured on *Anodonta cygnea*, and also exhibited a very fine series of specimens. The President addressed the meeting in March, his

subject "Mollusca of N.E. Yorkshire Past and Present" being ably dealt with and illustrated by a number of specimens from his collection. Although the April Meeting was devoted entirely to exhibits it was a great success and a record attendance. In May Mr. Greevz Fysher led the first excursion of the year, when a pond at Chapeltown, Leeds, was visited. Captures proved scarce but the afternoon was an enjoyable one. In conjunction with the Yorkshire Naturalists' Union and the York Field Naturalists' Club a meeting was held at Askham Bog, nr. York. The locality is an excellent one for conchologists and a long list of species was recorded. It was an ideal June day and one of the most successful excursions this year. In July an excursion was made to Wheatley Fish Ponds, Doncaster, under the leadership of Mrs. Morehouse (Doncaster). The Meeting was a joint one with the Yorkshire Naturalists' Union and the Doncaster Scientific Society. The attendance was excellent and shells were abundant. Mr. F. Rhodes, F.E.S. (Bradford) took charge of an excursion to Shipley Glen, in September. Shells were scarce but some species occurred in moss and dead leaves. At all indoor Meetings exhibits of interest have been shown and described. Membership has been considerably increased during the year and now stands at 51.

JOHN R. DIBB (*Hon. Sec.*).

REPORT OF THE NORTH STAFFORDSHIRE BRANCH.

THE members of this Branch continue to be keenly interested in the study of conchology, but I regret to say that owing to the widely separated districts in which they reside it is difficult to arrange meetings so as to get all the members together.

Field work still continues but most of the "finds" are only confirmations of earlier observations.

Mr. W. Hill contributes the following notes:—*Helix nemoralis* v. *rubella fascialba*, 00300 with very broad white calcified bands; v. *alba*, 00300, *roseolabiata* (nr. Leek); v. *hyalozonata*, 12345, 00345, 00300, beautiful translucent yellow shells (Stafford). *H. hortensis* of a brown shade with dark lips 00000, 123(45), Leek; 1(2345) Gt. Haywood. *A. arbustorum*, three distinct narrow bands round base of shell, Consall Woods. *V. substriata* has been taken in a new locality nr. Leek. *H. striolata*, scalariform, Consall. *H. excavata* v. *vitrina*, new locality, nr. Leek. *H. fusca* appears to have a wider range than hitherto thought at Consall. One shell obtained was perfectly clear and colourless. A flourishing colony of *T. haliotideia*, Drap., has been found in gardens at Barlaston, making the fifth station for this species in the Stoke-on-Trent area.

B. BRYAN (*Hon. Sec.*).

Unio margaritifer in County Clare, Ireland.—The known range of this species has been rendered more complete by its discovery in County Clare, where it was found quite plentifully in the River Cranny, near Ennis in July of present year by Mr. J. Abernethy of Edinburgh and I am indebted for voucher specimens to Mr. Liddy of Cranny. The presence of the Pearl Mussel in the river is well-known to the villagers of the district, who work the stream for the Pearls sometimes obtained.—JNO. W. TAYLOR.

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JOURNAL OF CONCHOLOGY.

VOL. 18.

MAY, 1928.

No. 7.

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New Members, Resignations, Deaths, etc. will be found in the Proceedings,
pp. 145-6, 180-2.

Range in Pembrokeshire of *Euparypha pisana* (Müller).—Mr. J. W. Taylor (Monograph, vol. 3, p. 394) defines the range of this snail as the coastal region between Saundersfoot and Manorbier. In June, 1927, I saw it in plenty on the burrows at Stackpole Warren, some five miles west of Manorbier, as the crow flies. At Freshwater East, about mid-way between Manorbier and Stackpole, there is much blown sand, but, although on the look-out for it, I failed to find *pisana* there in a walk across the whole breadth of the burrows. Mr. A. G. Stubbs, who studied its habits in the Tenby district, believes that *pisana* will oust *Helicella itala* (Taylor, op. cit., p. 375), and it is perhaps significant that *itala* was abundant at Freshwater East; but on the other hand the two species were living in association at Stackpole.—CHAS. OLDHAM (*Read before the Society*, September 10th, 1927).

THE MOLLUSCA OF THE 'ST. GEORGE' EXPEDITION.

(I.) THE PACIFIC COAST OF S. AMERICA.

BY J. R. LE B. TOMLIN, M.A.

(Read before the Society, November 2nd, 1927).

[Concluded from p. 170.]

Family TURBINIDÆ.

Turbo squamiger Reeve.

Conch. Syst. II, p. 167, pl. ccxx, f. 7, 1842.

Gorgona, living on shore.

Ranges from Gulf of California to Payta and the Galapagos.

Callopoma saxosum (Wood).*Turbo saxosus* Wood, Ind. Test. Suppl. p. 20, pl. vi, f. 45, 1828.

Panama, living on shore.

Ranges from Mazatlan to Payta and the Galapagos.

Astræa brevispina (Lam.).*Trochus brevispina* Lamarck, An. s. Vert. VII, p. 12, Aug. 1822.

Living on shore at Balboa and Panama.

Primarily a W. Indian species, which may have been introduced on the Pacific side of the Isthmus.

Family TROCHIDÆ.

Tegula pellis-serpentis (Wood).*Trochus pellis-serpentis* Wood, Ind. Test. Suppl. p. 16, pl. v, f. 4, 1828.

Isla del Rey, living ; Gorgona, dead.

Tegula reticulata (Wood).*Trochus reticulatus* Wood, Ind. Test. Suppl. p. 17, pl. vi, f. 38, 1828.

Living on shore at Panama and Isla del Rey. A species of the Panama province.

Tegula cooksoni (Smith).*Trochus (Omphalius) cooksoni* Smith, P.Z.S. 1877, p. 71, pl. xi, f. 7, 1877.

Not uncommon living on Cocos Is. ; dead on Charles Is. (Smith's original locality).

Tegula semigranosa (A. Ad.).*Phorcus semigranosus* A. Adams, P.Z.S. 1851, p. 157, 29/5/1853.

Living on Charles Is. and Narborough Is. ; dead shells in the Tagus Cove shingle.

Described—probably by error—as West Indian.

Tegula coronulata (C. B. Ad.).

Trochus coronulatus C. B. Adams, Ann. Lyc. N. Hist. New York V, p. 415, July 1852.

One fresh, dead shell found in a colony of *Pocillopora*. The original locality was Taboga.

Calliostoma leanum (C. B. Ad.).

Trochus leanus C. B. Adams, l.c.

Gorgona, living, with the last species; dredged alive in 12 f. off Tagus Cove, Albemarle Is.

Family FISSURELLIDÆ.

Fissurella macrotrema Sowerby.

P.Z.S. 1834, p. 125, 20/3/1835.

Living on Narborough Is. A Galapagos species.

Fissurella virescens Sowerby.

P.Z.S. l.c.

Living on Cocos Is. and at Panama; James Is., dead.

Fissurella asperella Sowerby.

P.Z.S. 1834, p. 127, 20/3/1835.

Panama and Indefatigable Is., alive; James Is., dead; shingle from Narborough Is. contained many small examples of what is probably this species.

Diodora alta (C. B. Ad.).

Fissurella alta C. B. Adams, Ann. Lyc. N. Hist. New York V, p. 460, July 1852.

Gorgona, living in colonies of *Pocillopora*.

Recorded from Mazatlan to Panama.

Family PATELLOIDIDÆ.

Collisella mesoleuca (Menke).

Acmæa mesoleuca Menke, Zeit. f. Malak. VIII, p. 38, July 1851.

Common living on Cocos Is.

Ranges from Gulf of California to Guayaquil and the Galapagos.

ORDER OPISTHOBRANCHIATA.

Family BULLARIIDÆ.

Bullaria rufolabris (A. Ad.).

Bulla rufolabris A. Adams, Thes. II, p. 577, pl. cxxiii, f. 76, 1850.

Living in 10-12 f. off Coiba; Dead shells on Gorgona, Charles and Narborough Is.

Family SCAPHANDRIDÆ.

Atys casta Carpenter (?).

Ann. Mag. N. Hist. (3) XIII, p. 314, Apl. 1864.

Dredged alive off James Is.

I am unable to identify this species definitely: *casta*, which came from Cape St. Lucas, has never been figured.

CLASS SCAPHOPODA.

Family DENTALIIDÆ.

Dentalium tessaragonum Sowerby.

P.Z.S. 1832, p. 29, 21/4/1832.

One dead shell dredged off Isla del Rey.

Ranges from Panama to Ecuador.

CLASS PELECYPODA.

Family NUCULANIDÆ.

Nuculana gibbosa (Sow.).

Nucula gibbosa Sowerby, F.Z.S. 1832, p. 198, 13/3/1833.

Coiba, valves common in 10 f.; Gorgona, living and many dead valves in 20 f.

Known as far south as Payta.

Adrana sp.

One large dead specimen and one smaller live one dredged off Gorgona.

Family ARCIDÆ.

Navicula pacifica (Sow.).

Byssarca pacifica Sowerby, P.Z.S. 1833, p. 17, 17/5/33.

Coiba, valves only; Gorgona, alive, one measuring 125 × 78 mm.

Ranges from G. of California to Payta.

Barbatia decussata (Sow.).

Byssarca decussata Sowerby, P.Z.S. 1833, p. 18, 17/5/33.

Coiba, 10–12 f.; Gorgona, among colonies of *Pocillopora*; Tagus Cove, Albemarle Is.; Charles Is. Living in all cases.

Acar gradata (Brod. & Sow.).

Arca gradata Broderip & Sowerby, Zool. Journ. iv. p. 365, Jan. 1829.

Living on Charles, James and Albemarle Islands; valves only on Narborough Is.

Mazatlan to Iquique and the Galapagos Is.

Anadara tuberculosa (Sow.).

Arca tuberculosa Sowerby, P.Z.S. 1833, p. 19, 17/5/33.

Gorgona Is., single valves.

Ranges from Lr. California to Tumbez.

Anadara formosa (Sow.).

Arca formosa Sowerby, l.c. p. 20.

Coiba, living on shore; Gorgona, single valves.

Known as far south as Payta.

Anadara secticostata (Reeve).

Arca secticostata Reeve, Conch. Ic. II, pl. vi, f. 38, Feb. 1844.

Coiba, valves dredged in 10–12 f.

Anadara aequatorialis (Orb.).

Arca ovata Reeve. tom. cit. pl. viii, f. 49, Feb. 1844 (non *A. ovata* Gm.).

Arca aequatorialis Orbigny, Voy. Am. Mérid. V. p. 636, 1846.
James Is., a single valve.

Fossularca solida (Sow.).

Byssoarca solida Sowerby, P.Z.S. 1833, p. 18, 17/5/33.

Tagus Cove, Albemarle Is., several living; Narborough Is., valves only.

Ranges from G. of California to Payta and the Galapagos Is.

Senilia grandis (Brod. & Sow.).

Arca grandis Broderip & Sowerby, Zool. Journ. IV, p. 365, Jan. 1829.

Coiba, a large, perfect dead shell dredged in 10 f.

Known as far south as Tumbez.

Glycymeris tessellata (Sow.).

Pectunculus tessellatus Sowerby, P.Z.S. 1832, p. 196, 13/3/33.

Very fine live examples dredged off Gorgona; a smaller form dredged living off Jicaron Is.; Coiba, living, and small valves common in 10 f.

Known from Cape S. Lucas to Ecuador.

Glycymeris multicostata (Sow.).

Pectunculus multicostatus Sowerby, l.c., p. 195.

Gorgona Is., dredged alive.

Known from Mazatlan to Guayaquil.

Family PINNIDÆ.

Pinna rugosa Sowerby.

P.Z.S. 1835, p. 84, 25/9/35.

Coiba, a dead shell.

Family PTERIIDÆ.

Pteria peruviana (Reeve).

Avicula peruviana Reeve, Conch. Ic. X, pl. xiv, f. 53, March, 1857.
Panama shore, alive.

Pinctada barbata (Reeve).

Avicula barbata Reeve, tom. cit. pl. v, f. 9.
Coiba, living.

Malleus aquatilis Reeve.

Conch. Ic. XI, pl. iii, f. 11, Nov. 1858.
Coiba, common, alive on shore.

Melina legumen (Gmelin).

Ostrea legumen Gmelin. Syst. Nat. ed. xiii, p. 3339, 1791.
Fairly common living on Charles Is., Albemarle Is. and Indefatigable Is.

Family OSTREIDÆ.

Ostrea callichroa Hanley.

P.Z.S. 1845, p. 107, Feb. 1846.

Gorgona Is., dead; James Is., dead; Coiba, living on shore.

Mainly a Chilean species.

Family SPONDYLIDÆ.

Spondylus princeps Broderip.

P.Z.S. 1833, p. 4, 17/5/33.

Dead only at Gorgona Is., and at Coiba Is. in 10-12 f.

Plicatula dubia Hanley.

Thes. Conch. I, p. 437, pl. xci, f. 19, 1846.

Gorgona Is., living on shore.

Panama to Guayaquil.

Family PECTINIDÆ.

Chlamys ventricosus (Sow.).*Pecten ventricosus* Sowerby. Thes. I, p. 51, pl. xii, f. 18, 19, 26, 1842.*Pecten tumidus* Sowerby. P.Z.S. 1835, p. 109 (non *tumidus* Turton).

Small valves only from Is. del Rey, Jicaron and Gorgona Is.

Known from Panama to Payta.

Chlamys sowerbyi (Reeve).*Pecten sowerbyi* Reeve. Conch. Ic. VIII, pl. i, f. 4, Nov. 1852.*Pecten aspersus* Sowerby. P.Z.S. 1835, p. 110 (non *aspersus* Lamarck).

A single valve at Balboa.

Chlamys (Lyropecten) subnodosus (Sow.).*Pecten subnodosus* Sowerby. P.Z.S. 1835, p. 109, 9/10/35.

Coiba, one valve in 10 f.; Gorgona, dead on shore.

G. of California to Guayaquil and the Galapagos Is.

Family LIMIDÆ.

Lima tetrica Gould.

Pr. Boston Soc. N. H. IV. p. 93, 1851.

Gorgona Is., very rare, dredged.

Lima angulata Sowerby.

Thes. I, p. 86, pl. xxii, f. 39, 40, 1843.

Panama, one dead shell.

Known from Panama to Juan Fernandez Is.

Family ANOMIIDÆ.

Placunanomia cumingii Broderip.

P.Z.S. 1832, p. 29, 21/4/1832.

This curious species was found alive on shore on the islands of Coiba, Jicaron and Gorgona.

Family MYTILIDÆ.

Modiolus capax (Conrad).

Modiola capax Conrad. J. Acad. Philadelphia VII, p. 242, 1837.

Coiba, living on shore; one very small example from Balboa may be this.

Ranges from Santa Barbara to Payta.

Modiolus planatus (Carpenter).

One perfect specimen and some small valves dredged off Gorgona Is.

I take the above name from the Brit. Mus. collections, but have failed to find it in print and am unable to say whether it has ever been published.

Brachidontes ovalis (Lam.).

Mytilus ovalis Lamarck. An. s. Vert. VI, pt. i, 121, 1819.

Indefatigable Is., several.

Brachidontes adamsianus (Dkr.).

Mytilus adamsianus Dunker. P.Z.S. 1856, p. 360, 8/5/1857.

Coiba Is., one living.

Known from Panama and Galapagos Is.

Lithophaga aristata (Dillwyn).

Mytilus aristatus Dillwyn. Descr. Cat. I, 303, 1817.

Living in several locs.: Coiba Is.; Gorgona Is., common; abundant in beach sandstone at north end of Taboga Is.; Tagus Cove, Albemarle Is.

A very wide-spread species: Gulf of California to Chili, Red Sea, Senegal, W. Indies and Portugal (here, no doubt, introduced).

Lithophaga plumula (Hanley).

Lithodomus plumula Hanley. P.Z.S. 1844, p. 17, July 1844.

Gorgona, living in colonies of *Pocillopora*.

Lithophaga attenuata (Desh.).

Modiola attenuata Deshayes. An. s. Vert., 2nd ed., VII, 28, 1836.

Living on Jicaron Is.; one dredged at Coiba, 10-12 f.

Known from the coast of Peru and Chili.

Lithophaga appendiculata (Phil.).

Modiola appendiculata Philippi. Abbild. II, 150, pl. i, f. 4, Oct. 1846.

Coiba, 10-12 f.

Family CUSPIDARIIDÆ.

Cardiomya californica (Dall.).

Cuspidaria (*Cardiomya*) *californica* Dall.

Bull. Mus. Comp. Zool. Harvard XII, no. 6, p. 296, Sept. 1886.

Gorgona Is., valves only, rare in 20 f.

Described from Catalina Island.

Family CRASSATELLITIDÆ.

Crassatellites undulata (Sow.).

Crassatella undulata Sowerby. P.Z.S. 1832, p. 56, 5/6/1832.

Gorgona Is., living on shore and dredged in 15 f.: the largest example measured 70 mm. in breadth.

Crassatellites gibbosa (Sow.).

Crassatella gibbosa Sowerby, l.c.

Coiba, one valve dredged in 10-12 f.

Gulf of California to Payta.

Family CARDITIDÆ.

Cardita tumida Broderip.

P.Z.S. 1832, p. 56, 5/6/1832.

Gorgona shore, not uncommon living; James Is. living.

Cardita tricolor Sowerby.

P.Z.S. 1832, p. 194, 13/3/1833.

Jicaron Is., dead; living on shore at Panama and Balboa, and in 10 f. at Coiba Is.

Cardita varia Broderip, l.c.

Gorgona Is. living on shore and in 15 f.

All three are species of the Panama province.

Mytilicardia pectunculus (Brug.).

Cardita pectunculus Bruguière, Enc. Méth., Hist. Nat. Vers I. 412, 1792.

Living at Balboa and Isla del Rey.

Family CHAMIDÆ.

Chama iostoma Conrad.

J. Ac. Nat. Sc. Philadelphia VII. 256, 1837.

Gorgona Is. on shore, common living; dead shells from Albemarle Is.

I am convinced that *sordida* Brod. is the young of this; young Gorgona examples are comparatively clean and free from growths and of a pretty pale coral-red. One of these is attached to a large valve of undoubted *iostoma*.

Chama echinata Broderip.

P.Z.S. 1834, p. 150, 3/4/1835.

Living on James and Albemarle Is.

Ranges from Panama to Peru.

Chama (Echinochama) arcinella (L.).

Chama arcinella L. Syst. Nat. ed. xii, p. 1139, 1767.

One living specimen and a single valve dredged off Coiba Is. in 10-12 f. I have not seen a record of this W. Indian species occurring on the Pacific side of the isthmus.

Family DIPLODONTIDÆ.

Diplodonta subquadrata Carpenter.

P.Z.S. 1855, p. 230, 5/2/1856.

Gorgona, valves only dredged.

Described from Mazatlan.

Family LUCINIDÆ.

Codakia galapagana Dall.

Pr. U.S. Nat. Mus. XXIII, 823, pl. xl, f. 4, 22/8/1901.

Valves common on Indefatigable and Narborough Is. The species was described from the former island.

Codakia mexicana Dall.

Op. cit. p. 822, pl. xl, f. 6.

A few valves from Indefatigable Is.

Family CARDIIDÆ.

Cardium (Trachycardium) senticosum (Sow.).

Cardium senticosum Sowerby. P.Z.S. 1833, p. 84, 8/9/1833.

Jicaron Is.

Ranges from G. of California to Payta.

Cardium (Trachycardium) consors (Sow.).

Cardium consors Sowerby. P.Z.S. 1833, p. 85, 8/9/1833.

Coiba, one valve dredged in 10-12 f.

Ranges from Gulf of California to Guayaquil and the Galapagos Is.

Cardium (Trachycardium) hornelli nom. nov.

Cardium maculosum Sowerby. P.Z.S. 1833, p. 85, 8/9/1833 (non *maculosum* Wood, 1815).

Cardium maculatum Sowerby. Conch. Ill., *Cardium*, p. 4, no. 56, f. 18, Jan. 1834 (non *maculatum* Gmel., 1791).

Gorgona, on shore.

As this species seems to have no valid name I have great pleasure in calling it after Dr. Hornell.

Cardium (Acanthocardia) belcheri (Brod. & Sow.).

Cardium belcheri Broderip & Sowerby. Zool. J. IV, 366, Jan. 1829.

Coiba Is., two or three valves dredged.

A rare Panamic species.

Papyridea aspersa (Sow.).

Cardium aspersum Sowerby. P.Z.S. 1833, p. 85, 8/9/1833.

Gorgona Is., valves on shore.

Known from Magdalena Bay to Guayaquil.

Lævicardium elenense (Sow.).

Cardium elenense Sowerby. Conch. Ill. *Cardium*, p. 6, no. 73, f. 58, 1840.

Taboga Is., valves dredged; Gorgona Is., dredged alive; James Is., alive; valves only from Narborough Is., and Tagus Cove, Albemarle Is. in 10 f.

A particularly pretty one dredged off Gorgona in 10 f. is more elongate than usual, measuring 25 mm. (from the umbones to outer margin) \times 20 mm., the measurements for length and breadth being usually as near as may be identical.

Gulf of California to Guayaquil and Clarion Is.

Fragum biangulatum (Sow.).

Cardium biangulatum Sowerby. Zool. J. IV, 367, Jan. 1829.

Coiba Is., valves in 10 f.; Gorgona Is., dredged alive.

Known from Catalina Is. to Guayaquil.

Fragum graniferum (Brod. & Sow.).

Cardium graniferum Broderip & Sowerby, l.c.

Coiba Is., valves in 10 f.; Gorgona Is., small live examples dredged.

Gulf of California to Guayaquil.

Family VENERIDÆ.

Macrocallista aurantiaca (Sow.).

Cytherea aurantiaca Sowerby. Gen. Shells, pt. 33, pl. lxxviii, f. 3, 1831.

Coiba Is., dredged alive in 10 f.; very fine live specimens from Gorgona shore.

G. of California to Guayaquil.

Macrocallista squalida (Sow.).

Cytherea squalida Sowerby. P.Z.S. 1835, p. 23, 16/4/1835.

Immature live examples from Coiba, 10–12 f. and Gorgona; valves from James Is.

Ranges from Cedros Is. to Peru.

Dosinia ponderosa (Gray).

Artemis ponderosa Gray, *Analyst* VIII, 309, 1838.

Tagus Cove, Albemarle Is.

Ranges from Magdalena Bay to Payta.

Dosinia dunkeri (Phil.).

Cytherea dunkeri Philippi. Abbild. I, p. 170, pl. ii, f. 5, Oct. 1844. Balboa, on the shore.

From G. of California to Tumbez and the Galapagos.

Chione grata (Say).

Venus grata Say. Amer. Conch. III, pl. xxvi, Sept. 1831.

Narborough Is., valves only.

Known from G. of California to Antofagasta.

Chione neglecta (Gray).

Venus neglecta Gray. Zool. Beechey's Voyage, p. 151, pl. xli, f. 8, 1839.

Dead shells at Balboa and Indefatigable Is.

Ranges from G. of California to Panama.

Chione gnidia (Brod. & Sow.).

Venus gnidia Broderip & Sowerby. Zool. Journ. IV, 364, Jan. 1829. Balboa, valves.

Known from Cedros Is. to Payta.

Chione (Lirophora) mariæ (Orb.).

Venus mariæ Orbigny. Voy. Am. Mérid. V, 563, 1846.

Venus cypria Sowerby. P.Z.S. 1835, p. 43, 1/6/1835 (non Brocchi, 1814).

Balboa.

Known from G. of California to Guayaquil.

Anomalocardia subimbricata (Sow.).

Venus subimbricata Sowerby. P.Z.S. 1835, p. 21, 16/4/1835.

Coiba Is., living in 10-12 f.

Known from G. of California to Payta.

Family TELLINIDÆ.

Tellina cumingii Hanley.

P.Z.S. 1844, p. 59, Sept. 1844.

Gorgona Is., valves dredged.

Eurytellina inæquistriata (Don.).

Tellina inæquistriata Donovan. Nat. H. Brit. Shells IV, pl. cxxiii, 1803.

Gorgona, a few valves dredged.

Apparently confined to the coasts of Ecuador and Peru.

Eurytellina princeps (Hanley).

Tellina princeps Hanley. P.Z.S. 1844, p. 62, Sept. 1844.

One large fresh valve from Isla del Rey.

Recorded only from Peru.

Metis dombei (Hanley).

Tellina dombei Hanley. Op. cit. p. 144.

One dead shell at Panama.

Peronidia bodegensis (Hinds).

Tellina bodegensis Hinds. Voy. Sulphur, Zool. II, 67, pl. xxi, f. 2, 1844.

Gorgona Is., one valve on shore.

Recorded from Brit. Columbia to G. of California.

Macoma grande (Hanley).

Tellina grandis Hanley. P.Z.S. 1844, p. 141, Dec. 1844.

One large shell at Tagus Cove, and another on Charles Is.

Known only from Peru.

Family SEMELIDÆ.

Semele flavescens (Gould).

Amphidesma flavescens Gould. Pr. Boston Soc. N. H. IV, 89, Nov. 1851.

Balboa, alive on shore.

Semele elliptica (Sow.).

Amphidesma elliptica Sowerby. P.Z.S. 1832, p. 200, 13/3/1833.

Balboa, one living.

Semele rupium (Sow.).

Amphidesma rupium Sowerby. Op. cit. p. 199.

Living at Tagus Cove, Albemarle Is. and at Charles Is.

Known from California to Ecuador and the Galapagos Is.

Family SOLENIDÆ.

Solen macha Molina.

Hist. Nat. Chile, p. 178, 1782.

I assign a young shell from I. del Rey to this Chilean species.

Macha alba (Q. & G.).

Solen albus Quoy & Gaimard. Voy. Astrolabe, Zool. III, 543, pl. lxxxiii, f. 11, 12, 1834.

Several examples, living and dead, from Coiba Is. 10-12 f., and Tagus Cove, Albemarle Is.

Originally described from Tonga-Tabou, but these are undoubtedly the same, and the Brit. Mus. has the same species without locality.

Family GARIDÆ.

Tagelus dombeii (Lam.).

Solen dombeii Lamarck. An. s. Vert. V. 454, 1818.

Small examples from Coiba and Jicaron Is.

Recorded from Peru and Chili.

Tagelus californianus (Conrad).

Solecurtus californianus Conrad. J. Acad. Philad. VII, 233, pl. xviii, f. 3, 1837.

Dredged dead, but fresh, off Is. del Rey.

Recorded from California and Mexico.

Family MACTRIDÆ.

Mactra (Mactroderma) velata (Ph.).

Mactra velata Philippi. Z. f. Malak. V, 153, March 1849.

Balboa, one fine, live specimen.

G. of California to Payta and the Galapagos Is.

Mactra (Mactrotoma) angusta (Reeve).

Mactra angusta Reeve. Conch. Ic. VIII, pl. xviii, f. 93, May, 1854.

Valves dredged off Is. del Rey.

Originally found at Panama.

Mulinia pallida (Brod. & Sow.).

Mactra pallida Broderip & Sowerby. Zool. J. IV, 360, Jan. 1829.

Balboa, one valve on shore.

Ranges from G. of California to Ecuador.

Raëta plicatella (Lam.).

Lutraria plicatella Lamarck. An. s. Vert. V. 470, 1818.

Many valves dredged off Is. del Rey.

Family CORBULIIDÆ.

Corbula pustulosa Carpenter.

Cat. Mazatlan Shells, p. 22, 1857.

Gorgona Is., valves common in dredgings

Corbula nuciformis Sowerby.

P.Z.S. 1833, p. 35, 17/5/1833.

Gorgona Is., dredged alive in 15 f.

Family PHOLADIDÆ.

Martesia acuminata (Sow.).

Pholas acuminata Sowerby. P.Z.S. 1834, p. 70, 25/11/34.

Living on Taboga Is.

A Panama species.



NOTES ON A COLLECTION OF LAND SHELLS FROM JAMAICA FORMED BY THE LATE GEORGE A. MARTIN.

By J. DAVY DEAN, F.E.S.

Of the Department of Zoology, National Museum of Wales.

(Read before the Society, November 2nd, 1927).

PLATE III.

MARTIN'S unexpected death in Jamaica, in May 1926, came as a fearful shock to his relatives and many friends, and to those who, like myself, were expecting big things of him. The youngest son of Henry W. Martin, of "Sherwood," Newport Road, Cardiff, he had always evinced a strong leaning to natural history and horticulture. He was very clever in the preservation and mounting of specimens, especially of insects, and his work while on the staff of the National Museum of Wales, Cardiff, bears splendid testimony to his capabilities. But he was essentially an outdoor man and he pined under restriction and routine. He was a born collector: nothing escaped his keen eyes, and for his collections he would only consider perfect specimens. His interest had turned to the mollusca and when he found himself in Jamaica in 1925 surrounded by big handsome *Helices* and exquisitely dainty operculates his whole energies went towards the formation of a collection of the shells of the island. But he had, while in Jamaica, recurring trouble from an illness which, he told me, had started when he was seventeen. This trouble became acute and it was while under an operation at Montego Bay that he succumbed—an operation which he had hoped would permanently cure him.

The sorting out of the material collected has been entrusted to me by Mr. Stuart H. Martin of Pontyclun. A full and representative series is to be given to the National Museum of Wales, another to the Museum at Merthyr Tydfil, and as the placing of all other duplicates is left to me, it is my wish to place a series, exhibited at this meeting, in the Manchester Museum. There are some thousands of specimens. All were live shells; nearly all are perfectly cleaned and in all cases the opercula are preserved. In this sense the collection is unique for there are many difficulties awaiting the collector in a climate like that of Jamaica.

What are the conditions in Jamaica? I take the following from some of Martin's letters. Rain falls generally in the rainy season between 11 a.m. and 5 p.m. At this time the shade temperature may be 95° at Kingston. The humidity may be anything from 80% to 100%, thus the heat in the tropics while not to be compared with temperatures like 150° in South Africa, or 130° in Palestine, is felt to

be more intense on account of the humidity. The rainfall at Kingston between January 1st and June 30th, 1925, was 53.40 inches. So much for climate. A letter written from Claremont, St. Ann (alt. 2750') says "this island would be heaven on earth for a naturalist IF it were not for mosquitoes. The species here are not malarial but, on the cooler, damp hillsides, under the trees, clouds of these small insects are on or around the face and hands persistently. Besides, there are scorpions, poisonous toads, and even disagreeable plants, such as the cow-itch bean (*Mucuna pruriens* DC.) with its velvet pods, every touch of which causes considerable irritation to the skin." At Williamsfield, Manchester, a species of tick has been introduced with cattle from Argentina, and this also causes considerable irritation.

The aspect of change cannot be overlooked. In Jamaica, as elsewhere, primitive woodland is being cut down and great tracts of country opened up for cultivation. Some species will adapt themselves to the new conditions, others will die out. Martin first took the rare *Anoma jarvisi* Pilsbry, on a small hill in St. Ann where all bush had been lately cut and burnt in preparation for planting. All shells were dead, some bleached and burnt. Some woods are cut, burned, cultivated and then left to go wild again. Bush springs up as before but there are no snails. Martin noticed that the ubiquitous *Helicina neritella* Lamk. varied in colour according to the type of tree it would be found on, and that a beautiful orange and chocolate variety was peculiar to the orange-trees at Claremont, a clear case of adaptability. But with extensive cultivation of tangerines, oranges, bananas, pines, grapefruit or pea-nut, on what was once primitive woodland or bush, there are other introductions.

Martin found that many inoperculate species were beautifully cleaned out by the Banana-fly. This fact he turned to good account by placing such shells as *Pleurodonte sinuata* Müll. in a box with two or three of the flies. These were allowed to lay their eggs inside the shells, which in a few days could be completely syringed and so cleaned. The introduction of the mongoose has had its effect on bird life. The Ground Quail has quite disappeared and Ground Doves no longer nest on the ground but in trees. Even rats, which fear the mongoose, have taken to making their nests on the tops of the Cocoanut Palms.

Martin made friends readily and preferred to stay in one locality, going out each day in different directions. Thus he was twice at Catadupa (2,700' alt.). Later he writes "I am now staying with Sergeant George A. Martin at King's House, in the West Lodge." The big house, standing in 100 acres, is the Governor's Residence near Kingston, where *Strophocheilus oblongus* Müll. and *Oxystyla undata* var. *jamaicensis* Pilsbry, both introduced species, were found in

abundance. *S. oblongus* must be a recent introduction for it is not mentioned by the earlier writers.

A list of localities, each more or less thoroughly worked for land-mollusca might perhaps be given here :

Kingston, Half-way-tree and Constant Spring in St. Andrew.

Cascade in Portland.

Linstead and Mt. Zion (part) in St. Catherine.

Claremont, Gibraltar, Mt. Zion (part) and Caledonia in St. Ann.

Catadupa in St. James.

Bellfield Mt. and Williamsfield in Manchester.

NOTES ON THE SPECIES.

It is perhaps not generally known that there is a genus of land-shells with habits as peculiar as the singular marine genus, *Xenophora*. This is *Thysanophora*, of which there are several allied species. All cover the shell with a dark substance to resemble bark and sometimes this is exchanged for a light material to resemble lichen. Martin believed leaf-soil to be the material used because the soil itself was red where the various species occurred. This leaf-soil is stuck on at close intervals like cogs on a wheel and is exceedingly brittle. The resemblance to bark or lichen is so close that detection is difficult. In the case of *T. ptychodes* Pfr., the largest and flattest of the species, the resemblance to a cogged wheel is remarkable. *T. turbiniformis* Pfr. is trochoidal and here the early whorls are plastered over and obscured and those succeeding are curiously decorated with a series of knobs or tubercles. Underneath all this camouflage is an almost transparent shell.

The primitive Helicidæ of Jamaica are represented by the three genera *Sagda*, *Thysanophora* and *Zaphysema* of which several species were collected, principally at Catadupa, close to the newly opened up Cockpit country.

Mention is made by Martin of the habitats of two species of *Dialeuca* and of *Hemitrochus graminicola* Ad., all peculiar to the island. *Dialeuca nemoraloides* Lk. was collected at Mt. Zion in some numbers in the hollows of the limbs of the bread-nut trees (*Brosimum alicastrum* Sw.). *D. conspersula* Pfr. has a hydrophanous epidermis flecked with silver markings. When wetted these marks vanish, leaving the shell dark and inconspicuous as the snails move about on the Bromiliad leaves, on which they are to be found. *Hemitrochus* is found in the same station, in the axils of the dead leaves of these plants, which cling to the branches of certain trees for support but not parasitic as are the orchids, with which they are found.

Intermingling in this jungle growth are the Arioids, a smaller type of plant again, depending on the branches of the trees although not parasitic. *Dialeuca conspersula* occurred at Catadupa and Claremont and *Hemitrochus* at Williamsfield.

The great *Pleurodonte* peculiar to Jamaica, are mostly ground snails. *P. sinuata* Müll. and *P. picturata* Ad. were found at Catadupa under rotten logs: *P. schroeteriana* Pfr., high up on the leaves of the trees. *P. cara* Ad. was taken in fair numbers in a coffee-field at Williamsfield under stones. *Eurycratera* or *Pleurodonte jamaicensis* Gmel. is much resorted to by the red and blue Soldier Crabs.

The greatest prize awaiting the collector in Jamaica is *Anoma*. Never common, always local, always demanding the most serious search and individual examination of any particular foliage, several beautiful species are exceedingly rare. The following brief account may show this: 'Yesterday Atkinson and I went about five miles expressly to look for *Anoma* on a certain hill (Catadupa) but failing here Atkinson said "Busher, let's try a new hill" so we did, two other black boys coming also. Soon after, one little chap came up holding two tiny shells in his black hand and said "These any good, Busher?" They were two fresh specimens of *Anoma cinerea* Ad. The shells occur high up in heavily wooded precipitous slopes on the leaves of the trees, and collecting is slow work.'

At Gibraltar Martin took a few living specimens of *Anoma jarvisi* Pils. and found that the species favoured wild fig, pimento (*Pimento officinalis* Lindl.) sweetwood (*Misanteca triandra* Mez.) and black bullet tree, and on these trees and in the same locality he took also a fine series of *Anoma splendens* Pfr. and its variety *citrina* Ad.

Microceramus gossei Pfr. a shell not very unlike the European *Abida cinerea* Drap. in colour, although smaller, affects similar situations and is locally abundant on limestone walls at Williamsfield in the Manchester Province.

Both *Brachypodella gracilis* Wood and *B. chemnitziana* Fér. were taken on walls on the limestone in the St. Ann Province, the former at Claremont and the latter on Mt. Zion. *B. gracilis* was found also to be abundant on Bellfield Mt. at Williamsfield, further west. *Drymæus immaculatus* Ad. was found in abundance at Caledonia on tangerines and on the banana plants; always along the mid-rib under the drooping leaves.

There are a few notes sent with some of the operculates which are of interest. *Parachondria augustæ* Ad. was taken in some numbers on cliffs at Cascade in the Blue Mountains, at an altitude of 2,000 ft. The country has been mostly cleared of bush and planted with yams,

pimento, pineapple, bananas, cocoa, maize, etc. The bush was higher up but Martin did not succeed in getting to it owing to heavy and continuous rains.

Annularia appears to be very local but common where it occurs. *A. scabriuscula* Ad. was sometimes taken on the leaves of trees, when the resemblance to a torn piece of leaf curled over dead was so near that one had to look twice ; or if on rocks, then again the resemblance to the rock itself was very close. Further, some of these species 'blow bubbles' as Martin put it in his letters, to avoid detection. The curious bifurcated foot of *Colobostylus humphreyanus* Pfr. each half working independently was specially noted by him and sketched. This gives a most ghostly glide to the snail ; I have not seen this motion commented upon, although it must surely have been noted before ; Fig. 1. Its progress is the opposite of our own familiar little beer-barrel—*Euconulus fulvus* Müll. Still more extraordinary is the method of progress employed by the tiny species of the *Geomelania*. The movement is similar to that of a looper caterpillar and from Martin's sketches I have selected three as showing the action ; Fig. 2.



Fig. 1.

Helicina neritella Lk. is one the commonest and most variable of Jamaican shells and enjoys a wide range. Martin found the white variety most frequent on pimento trees and another beautiful variety conspicuously marked with alternate brown and yellow blotches, on the orange trees. *Helicina jamaicensis* is always plastered with earth and slime, and resembles the sun-



Fig. 2.

burnt patches on leaves ; it also 'blows bubbles' if disturbed. *Helicina aurantia* Gray is also well coated with earth and was commonly taken on the upper side of the tangarine leaves ; also on those of the beef tree, bitterwood, maroon wattle, wild bread-nut, etc. Curiously enough the lip of the shell which is normally bright orange in Mt. Zion was, at Gibraltar, a pale primrose yellow, though no reason for this variation could be detected. *Helicina ampliata* Pfr. was taken only at one spot near Catadupa, on the dead leaves of the plants parasitic on a hugh cottonwood tree. The beautiful species of *Alcadia* peculiar to Jamaica seem to favour the so-called honey-comb limestone and have to be poked out, though the smaller species are often found under loose stones.

This list does not cover all the species collected ; between one and two hundred were obtained, but of course a great many adopt varied habitats, under stones or moss under conditions that may not have called for special mention. In the working out of the material I have to offer many thanks to Mr. J. R. le B. Tomlin, and for his offer to compare some of the more difficult species with the Chitty Collection at South Kensington. A lot of work has still to be done for there is considerable colour variation, and I may have something to say later regarding the more critical species, but for the present it seems better to leave these notes as they now stand as a record of good work done. I conclude by drawing attention to the fine photograph received of *Strophocheilus oblongus* Müll. here reproduced (Plate 3) and only regret it was not followed, as it might have been, by many other similar studies.



Vertigo alpestris var. **albina** in Westmorland.—Among several hundred specimens collected on stone walls at Elterwater in Langdale, Westmorland (v.c. 69) in July, 1927, there was a single example with a translucent white shell.—A. E. BOYCOTT (*Read before the Society*, December 7th, 1927).

Littorina rudis var. **tenebrosa** Mont.—The mill-pond at Walton-on-Naze which Mr. Dacie refers to (antea p. 143) used to be a good locality for sundry brackish water mollusca. It has now been converted into a boating-lake and is much too clean and barren for shells. A casual inspection of the neighbouring salt-marshes in June, 1927, failed to disclose any *Litt. rudis*, though its usual associates *Paludetrina ventrosa* and *Card. edule* var. *rustica* were there in plenty. In 1895 this form of *Litt. rudis* occurred in profusion in the Lantern Marsh at Aldeburgh, but in July this year none were to be seen in the upper part of the marsh. The shell still lives in some of the ditches nearly a mile south of Slaughden. This seems to confirm Mr. Dacie's theory that the extraordinary tides of November, 1925, swept the contents of the brackish ditches into the sea.—J. E. COOPER (*Read before the Society*, Sept. 10th, 1927).

THE MOLLUSCA OF LAKE ALBERT NYANZA.

By M. CONNOLLY.

(Read before the Society, May 7th, 1927).

[Concluded from p. 179].

(b) FOSSIL SPECIES.

The Kaiso fossils were obtained from a bed of ferruginous sandstone, whose age, based on the examination of vertebrate remains from the same locality, has been determined as late Pliocene or Plio-Pleistocene, which is rather remarkable in view of the fact that none of the Mollusca represent species now living in Lake Albert, and that most of them are extinct, whereas other deposits, referred to as old, or an older age, by the authorities on vertebrates, contain extremely few Mollusca other than are still living in situ or in other parts of the Continent.

As Cox aptly remarks, this extraordinary fossil fauna must show that the conditions of molluscan life in Lake Albert have changed very much for the worse, in comparison with some of the other lakes, when so many species have decreased in stature or died out, during the same period in which, in other localities, there has been little variation, or even an increase in size of their inhabitants.

Family VIVIPARIDÆ.

Genus *Viviparus* Montf.

Viviparus alberti Cox.

1926 *Viviparus alberti* Cox, Geol. Palæont. Kaiso, p. 58 ; pl. viii, f. 1-3.

Hab. Kaiso, East of Lake Albert (Wayland): I will not repeat the locality, as all the fossils were collected there by him.

Viviparus waylandi Cox.

1926 *Viviparus waylandi* Cox, l.c., p. 59 ; pl. viii, f. 6-7.

Viviparus turris Cox.

1926 *Viviparus turris* Cox, l.c., p. 59 ; pl. viii, f. 8.

Viviparus sp. n.

1926 *Viviparus* sp. nov. "A," Cox, l.c., p. 61 ; pl. viii, f. 10.

A remarkable form, which may belong to *Pila* rather than the present genus, but so far only fragments lacking the spire have come to hand.

Viviparus dubius Cox.

1926 *Viviparus* (*Neothauma*?) *dubius* Cox, l.c., p. 60 ; pl. viii, f. 4, 9.

Apparently a *Neothauma*, and very interesting as pointing to former connection between Lakes Albert and Tanganyika.

Family THIARIDÆ.

Genus **Thiara** Bolten.**Thiara brevissima** Cox.1926 *Thiara brevissima* Cox, l.c., p. 63; pl. ix, f. 1-2.Genus **Cleopatra** Trosch.**Cleopatra cf ferruginea** (Lea).1926 *Cleopatra cf. ferruginea* Lea, Cox, l.c., p. 65; pl. viii, f. 5.

Family UNIONIDÆ.

Genus **Cælatura** Conrad.**Cælatura** sp.1926 *Unio (Nodularia)* sp. indet., Cox, l.c., p. 67.Genus **Parreysia** Conrad.**Parreysia** sp.1926 *Unio (Parreysia)* sp. nov., Cox, l.c., p. 68; pl. ix, f. 4.

Family MUTELIDÆ.

Genus **Pleiodon** Conrad.1926 *Pleiodon* sp. nov., Cox, l.c., p. 69; pl. ix, f. 5.

Another noteworthy occurrence of a genus, chiefly confined to L. Tanganyika, in the earlier age of Lake Albert.

Genus **Mutela** Scop.**Mutela** sp.1926 *Mutela (Mutelina)* sp. indet., Cox, l.c., p. 69; pl. ix, f. 3.

Closely related to *M. alluandi* Germ., but of greater proportionate length; although slightly deficient at each end, it measures 100 × 37 mm. in length and height, with a thickness of 21 mm., while *alluandi* is stated to be 84 × 37 mm. and 31 mm. in diameter.

Family ETHERIIDÆ.

Genus **Etheria** Lam.**Etheria elliptica** Lam.

1807 *Etheria elliptica* Lam., Ann. Mus. H.N. Paris, x, p. 401; pl. 29; pl. 31, f. 1.

1926 *Aetheria elliptica* Lam., Cox, l.c., p. 67.

It is remarkable that this widely diffused species, although abundant in live condition in L. Victoria Nyanza, appears to have become extinct in Lake Albert.

It will be seen from the foregoing pages that if we eliminate *Potadoma liricincta* and *tornata*, *Cleopatra guillemei*, *Parreysia teretiuscula* and *Aspatharia stuhlmanni*, owing to their actual existence in the lake being unproven, there remains a total of twenty recent species

now known to inhabit it, while the fossils amount to twelve, none of which, with the possible exception of *Mutela alluandi*, occur there in recent condition, and two of the genera, *Pleiodon* and *Etheria*, do not appear in its recent representation.

Collections of fossils, containing a few freshwater shells, have been recorded from only five other districts in Central Africa, and it may be not without interest to summarise them here:

(a) The lake plain at the north-west corner of Lake Nyasa (vide Bullen Newton¹ and Connolly²).

This deposit, which Bullen Newton very reasonably considered, on conchological grounds, to be quaternary, has since been determined, owing to vertebrate remains, as of late Miocene age; the mollusca are *Lanistes solidus* Smith or *ovum* Ptrs.; *Cleopatra bulimoides* (Oliv.); *Viviparus unicolor* (Oliv.); *Melanoides tuberculatus* (Müll.); *Cleopatra ferruginea* (Lea); *Corbicula africana* (Krs.).

(b) Gottorp, Tanganyika Territory (vide Dietrich³).

Presumed to be of late tertiary age, the deposit only contained a single aquatic species, which Dietrich described as new under the name of *Lanistes recki* and compared with *L. stuhlmanni* Mts.

(c) Miocene beds south of Kavirondo Gulf, Lake Victoria Nyanza (vide Bullen Newton⁴): *Pila ovata* (Oliv.); *Lanistes carinatus* (Oliv.); *Cleopatra bulimoides* (Oliv.); *Cleopatra exarata* Mts.

(d) Deposits of late Tertiary or post-Tertiary age near the south-west corner of Lake Albert Edward (first mentioned by von Martens, and epitomised by Germain⁵): *Planorbis sudanicus* var. *major* Mts.; *Planorbis choanomphalus* Mts., cum var. *basisulcatus* Mts.; *Viviparus unicolor* (Oliv.) var. *conoidea* Mts.; *Bulimus alberti* (Smith); *Bulimus humerosus* (Mts.); *Melanoides tuberculatus* (Müll.); *Unio ngesianus* Mts.; *Corbicula radiata* (Phil.).

(e) Beds near Kasinga, at the north-east corner of Lake Albert (vide Cox, l. c. 1926), which are supposed to be of the same age as the Kaiso deposits of Lake Albert Nyanza: *Viviparus unicolor* (Oliv.); *Viviparus* sp. n., but imperfect; *Cleopatra bifidicincta* Cox, sp. n.; *Cleopatra* sp. (?).

I make no special mention of yet another deposit, which Smith⁶ considered to be of late Post-Pliocene age, at Sumbu and the Rukwa Valley, near the East shore of Lake Tanganyika, as the material collected there was not sufficient for proper determination.

(1) Q.J.G.S., lxvi, 1910, p. 239.

(2) Do. lxxxiii, 1927, p. 444.

(3) Centralbl. Min., 1923, p. 316.

(4) Q.J. G.S., lxx, 1914, p. 187.

(5) Bull. Mus. Paris, 1916, p. 193.

(6) P.Z.S., 1906, p. 15.

Three points of interest will be noticed in the foregoing distribution :

The first is that no really extinct species have occurred in deposits (a), (c) and (d), two of which are held to be Miocene, whereas the majority of species from deposits (b), (e) and Kaiso, which are considered to be Plio-Pleistocene, are extinct.

The second is the prevalence in all but two deposits of the small typical Nilotic forms of either *V. unicolor* or *Cleo. bulimoides* (Oliv.), which have not recently been reported from the vicinity in living condition, but may have developed, under local influence, divergent characteristics.

The third point is the absence of both *unicolor* and *bulimoides* from Kaiso, and the fact that the fossil species of *Viviparus* and *Cleopatra* in this bed attain dimensions larger than, or at least as large as any members of those genera now living in Africa.



Helix pisana (Müll.) in South Australia.—This subdominant or conditionally dominant species which has been widely distributed to many distant parts of the world by commerce has now made its appearance in South Australia where it is now apparently well established. A few specimens were picked from the palm trees growing near the docks at Adelaide a few months ago by the daughter of our valued colleague Mr. W. Gyngell of Scarborough, and brought over to England living, all of which may be referred to the var. *musica* of Monterosato. This is believed to be the first record of its occurrence in Australasia.—J. W. TAYLOR.



Vertigo moulinsiana (Dupuy) near Norwich.—At Brundall, some six miles from Norwich, where an area of fen extends between the railway and the River Yare, numbers of *Vertigo moulinsiana* were found amongst tussocks of *Carex paniculata* in April, 1927. With the exception of the Keswick locality, this appears to be the most northerly record for the species in the British Isles. Great numbers of *Vertigo antivertigo* (Drap.) were present on *Glyceria aquatica* in this fen, but the two species were seldom found together, the one being confined to the sedge and the other to the grass, except for a few *V. antivertigo* found under one of the tussocks with *V. moulinsiana*. The other species recorded from this locality were *Succinea putris*, *S. elegans*, *Vallonia pulchella*, *Carychium minimum*, *Punctum pygmaeum*, *Goniodiscus rotundatus* (scarce), *Cochlicopa lubrica*, *Limnaea truncatula*, *Ashfordia granulata*, *Trichia hispida*, *Arianta arbustorum*, *Arion ater*, *Zonitoides nitidus*, *Vitrea crystallina*, *Euconulus fulvus*, *Oxychilus cellarius*, *Agriolimax laevis*, and *A. agrestis*.—A. E. ELLIS (Read before the Society, September 10th, 1927).

THE FIRST KNOWN OCCURRENCE OF LIMAX TENELLUS Müll. IN BRITAIN.

By C. OLDHAM, F.L.S.

(Read before the Society, January 4th, 1928).

IN the "Transactions" of the Tyneside Naturalists' Field Club for 1847 (Vol. I, pt. ii, pp. 97-209), published in 1848, appeared a paper by Joshua Alder entitled a "Catalogue of the mollusca of Northumberland and Durham." This paper was issued subsequently as a separate publication with different pagination. On page 125 in the original paper and page 31 of the reprint we read under the heading, "*Limax tenellus*":

"In a wood at Allansford, near Shotley Bridge.

"A specimen of this interesting species was brought us from the
"above locality by Mr. Blacklock." [Here follows a description].

"Wishing to have the opinion of the Rev. B. J. Clarke, whether
"this was the young of any of the species he has so admirably
"described, we sent him a drawing and description of it."

No date was cited by Alder for the occurrence nor was the specimen allocated specifically to Northumberland or Durham.

Forbes and Hanley in their "History of British Mollusca, and their Shells" (Vol. IV, p. 21, 1852) follow Alder's spelling of the place-name "Allansford," but mis-spell Shotley as "Shortly" and assign the locality to Northumberland.

In his "British Conchology" (Vol. I, p. 140, 1862) Gwyn Jeffreys, who, incidentally, was frankly sceptical about the existence of *Limax tenellus* in Britain, not only repeats Forbes and Hanley's error, but states that Alder "published the discovery in the 'Transactions of the Northumberland and Newcastle-upon-Tyne Natural History Society'," the reference presumably being, as indeed the item in the Bibliography on p. 321 suggests, to Alder's "Catalogue of the Land and Fresh-water Testaceous Mollusca found in the vicinity of Newcastle-upon-Tyne, with Remarks," which appeared in Vol. I, part i (1830) of the "Transactions" of the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne. Neither in this Catalogue nor in the supplement to it which was published in Vol. II (1838) is there any mention of *Limax tenellus*.

Allansford, or Allensford as the name is spelled on the one-inch map of the Ordnance Survey and in Bartholomew's "Survey Gazetteer of the British Isles," is a place in North Durham, on the bank of the Derwent, two miles W.S.W. of Consett and about the same distance

upstream from Shotley Bridge. The Derwent thereabouts marks the boundary between Northumberland and Durham, and, if Blacklock's slug was actually collected at Allensford, Taylor is right ("Monograph of the Land and Freshwater Mollusca of the British Isles" Vol. II, p. 75) in ascribing it to Durham.

Canon A. M. Norman's copy of Forbes and Hanley's work came into my hands at the sale of his library in 1919. Among various drawings and memoranda that had been inserted between the leaves was a water-colour drawing of *Limax tenellus* in three positions. This drawing is now incorporated in Alder's collection of Mollusca in the Hancock Museum, Newcastle-upon-Tyne. On the card on which the drawing is mounted is a note, "*Limax tenellus*. Drawing by Joshua Alder," in Canon Norman's handwriting. The sheet on which the figures are drawn has several memoranda in black-lead pencil, which Mr. T. Russell Goddard, the curator of the Hancock Museum, assures me are in Alder's own hand. The date, "1846," is strong presumptive evidence that the specimen was collected in that year. A discolouration of the paper above the words "Stain from the mucus" indicates that the drawing was made from the living slug: the words "Nat. size" under the smallest of the three figures, that the specimen was a young one, only 29 mm. in length when extended; the words "*Limax tenellus*, Catal. Northd. & Durham," that the specimen was the one referred to in the paper read by Alder in 1847; and the words "Figured from this in 'British Mollusca,' Pl. FFF* f. 3" associated with the middle figure, a spirited drawing 60 mm. long, or about twice the length of the living specimen, that this was the original of the figure in Forbes and Hanley's work. This drawing, reduced by one third, was the basis of fig. 1 on Plate X of Vol. II of Taylor's "Monograph," and, at second hand, of fig. 5 on Plate XIV, of Ellis's "British Snails." The figure on Plate VI *bis* of Rimmer's "Land and Freshwater Shells of the British Isles" suggests the same source, probably at second hand and from Forbes and Hanley's figure.

Limax tenellus is now known to be widely distributed in Britain and to abound in suitable habitats—old woodlands, but its history is an apt illustration of how an animal may be overlooked if we are ignorant of its mode of life. Even five-and-twenty years ago little was known of its mycophagous and subterranean habits, and from the time when Blacklock's specimen was found until Godfrey's sensational discovery in the Forest of Rothiemurchus in 1904, a period of nearly sixty years, there was no well authenticated case of its occurrence in this country.

NON-MARINE MOLLUSCA FROM WEST AFRICA.

By GEO. C. SPENCE.

(Read before the Society, September 10th, 1927).

PLATE II.

MR. F. M. DYKE has again returned from Africa after a tour which embraced portions of the Gold Coast, Nigeria and the Cameroons. Unfortunately the best season for travelling does not coincide with the most favourable period for collecting purposes and for three months of the time not a drop of rain fell. Nevertheless some 34 species were secured, of which two appear to be new to science, and as on previous occasions Mr. Dyke has been good enough to entrust the material to me to be reported on. The usual careful field notes as to habitats, etc., have been made and are incorporated below. My thanks are due to Major Connolly for assistance in the determination of critical species.

Collections were made at the following localities, viz. :

Gold Coast. Bunso Plantation, $0^{\circ}28'$ W., $6^{\circ}18'$ N.

Nigeria. Okaki, $6^{\circ}20'$ E., $5^{\circ}5'$ N.

Abonema, $6^{\circ}50'$ E., $4^{\circ}45'$ N.

Opobo, $7^{\circ}30'$ E., $4^{\circ}25'$ N.

Sapele, $5^{\circ}25'$ E., $5^{\circ}55'$ N.

Enyong River, $7^{\circ}55'$ E., $5^{\circ}10'$ N.

Cameroons. Ferme Suisse, $10^{\circ}7'$ E., $3^{\circ}35'$ N.

Nyong River, $10^{\circ}10'$ E., $3^{\circ}35'$ N.

Bunso Plantation is situate amongst low hills, densely wooded, and is devoted to cocoa growing. On the estate there is some 10 to 15 feet of loamy soil overlying a gold bearing gravel. The climate is very hot and moist and vegetation most luxuriant. The Birrim River flows through the estate and is of interest as being the stream in which Gold Coast diamonds were first found.

Ferme Suisse, nr. Edea, is a small palm and rubber plantation situate in the fork formed by the rivers Nyong and Onge.

FAMILY STREPTAXIDÆ.

Genus **Edentulina** Pfeiffer 1855.

Edentulina liberiana (Lea).

Hab. : Ferme Suisse.

Genus **Gonaxis** Taylor 1877.

Gonaxis camerunensis (d'Ailly).

Had. : Ferme Suisse. Bunso Plantation.

Under dead wood. Variable in size. The Ferme Suisse examples approximate to d'Ailly's dimensions, diam. maj. 16, min. 11; alt. 11 mm. whilst the Bunso shell is much smaller, viz. $12 \times 9 \times 9$ mm.

Genus **Streptostele** Dohrn 1866.*Streptostele buchholzi* Mts.

Hab. : Bunso Plantation. Under dead wood.

Genus **Ptychotrema** Mörch 1852.*Ptychotrema (Excisa) boangolensis* (d'Ailly).

Hab. : Bunso Plantation.

Under dead wood. One example of this apparently rare and exquisite little shell.

Pytychotrema (Ennea) complicata Mts.

Hab. : Ferme Suisse.

Genus **Gulella** Pfeiffer 1856.*Gulella (Paucidentina) monodon* (Mor.).

Hab. : Bunso Plantation. Under dead wood.

FAMILY ZONITIDÆ.

Genus **Thapsia** Albers 1860.*Thapsia troglodytes* (Mor.).

Hab. : Ferme Suisse. Under stones.

Several examples in various stages of growth of this handsome species.

Genus **Gudeëlla** Preston 1913.*Gudeëlla calamechroa* (Jonas).

Hab. : Bunso Plantation. Under dead wood in bush.

Genus **Trochozonites** Pfeiffer 1883.*Trochozonites talcosus* (Gould).

Hab. : Bunso Plantation, Abundant under dead wood in bush.

Trochozonites reticulatus (d'Ailly).

Hab. : Ferme Suisse.

Genus **Helixarion** Fér. 1821.*Helixarion (Zonitarion) semimembranaceus* (Mts.).

Hab. : Ferme Suisse. Under stones.

FAMILY ENDODONTIDÆ,

Genus **Trachycystis** Pils. 1893.*Trachycystis seminium* (Mor.).

Hab. : Bunso Plantation. Under dead wood in bush.

FAMILY VAGINULIDÆ.

Genus **Pleuroprocta** Simroth 1913.*Pleuroprocta silvatica* Pils.

Hab. : Bunso Plantation. On dead banana leaves.

FAMILY ACHATINIDÆ.

Genus *Pseudachatina* Albers 1850.*Pseudachatina elongata* Pfr.

Hab. : Ferme Suisse.

Genus *Achatina* Lamarck 1799.*Achatina marginata* (Swainson).

Hab. : Ferme Suisse. Two typical examples measuring respectively 100 and 124 mm. in length.

A. marginata (Swainson) var. *gracilior* Mts.

Hab. : Okaki, in thick bush. A richly-coloured form. Highly esteemed by the natives as food.

A. marginata (Swainson) var. *fourneaui* Germain.

Hab. : Opobo. One specimen, which has evidently been collected for culinary purposes, of this small thin form. Weight of shell 230 grs.

Achatina ventricosa (Gould).

Hab. : Bunso Plantation. A few feet up trunks of rubber trees.

Subgenus *Leptocala* Ancey 1888.*Achatina* (*Leptocala*) *mollicella* Mor. (Plate II, fig. 5).1876. *Achatina pulchella* Mts. Monatsber. p. 258, T. 3, Figs. 1, 2.1884. *Petitia petitia* Jouss. Bull. Soc. Zool. France, p. 172, Pl. 4, fig. 4a.1889. *Achatina smithi* Sow. P.Z.S. London, p. 579, Pl. 56, fig. 3.1890. *Achatina sowerbyi* Sm. A.M.N.H. vi. p. 392.

Hab. : Ferme Suisse.

This Cameroon shell which agrees absolutely with Martens' original description and figures of *pulchella* is also identical with Morelet's type of *mollicella* in the N. H. Mus., South Kensington. Further, d'Ailly, with apparently good reason, unites *petitia* and *smithi* with *pulchella*.

Genus *Limicolaria* Schumacher 1817.*Limicolaria numidica* (Rve.).

Hab. : Sapele. One damaged adult, remarkable on account of its extreme tenuity. This shell weighs only 5 grs. as against the 12 grs. of an immature example of the same size.

L. numidica (Rve.), form *unicolor pallida*. (Var. B. Shuttleworth).

Hab. : Opobo.

Limicolaria abinsiensis Shackleford and Spence. (Plate II, figs. 7/9).

This and other species of *Limicolaria* are used as tops by the native children who break off the base and spin them with a twist of the fingers.

Fig. 9 is *abinsiensis* whilst the other figs. No. 7 and 8 represent a richly-coloured indeterminate form which may eventually prove to be allied to *numidica* (Rve.).

Genus **Pseudotrochus** H. & A. Adams 1855.

Pseudotrochus solimanus (Mor.).

Hab. : Ferme Suisse. Both plain and doubled-banded forms.

Genus **Homorus** Albers 1850.

Subgenus **Subulona** Mts. 1889.

Homorus (Subulona) involutus (Gould).

Hab. : Bunso Plantation.

Genus **Subulina** Beck 1837.

Subulina octona (Brug.).

Hab. : Bunso Plantation. Numerous examples of this most successful colonizer, and as usual, full of eggs.

Subulina angustior (Dhn.).

Hab. : Opobo, Ferme Suisse. Under stones.

An embryonic shell, is pale glassy, flattened dome shape, consisting of $2\frac{1}{2}$ whorls which gradually develop crenulations below the suture. Columella short, straight and abruptly truncate.

Genus **Pseudoglessula** O. Bttg. 1892.

Subgenus **Dictyoglessula** Pils. 1919.

Pseudoglessula retifera Mts.

Hab. : Ferme Suisse.

Subgenus **Pseudoglessula**, s.s.

Pseudoglessula strigosa (Morelet).

Hab. : Bunso Plantation. Under dead wood.

Genus **Pseudopeas** Putzeys 1899.

Pseudopeas guineense (Jonas).

Hab. : Bunso Plantation. Under dead wood in bush.

Pseudopeas egens (d'Ailly).

Hab. : As last. Eggs very small, white, and globular.

Pseudopeas opoboense n. sp. Plate II, fig. 6.

Shell very small, perforate, consisting of four well-rounded whorls of which the nepionic ones are large, dome-like and microscopically coarsely spirally striate. Remainder weakly sculptured with slightly curved low costulae about one-half the width of the intervening spaces. Suture crenulated by the ends of the ribs. Columella straight and reflexed over the perforation. Aperture pyriform.

Length 3.0, lat. 1.5; aperture, alt. 1.0, lat. 0.6; length of last whorl 2.0 mm.

Hab. : Opobo. One specimen only.

Near to *camerunense* Conn. but not so elongated and vertical ribs much weaker.

Genus **Curvella** Chaper 1885.

Curvella redfieldi Pils.

Hab. : Bunso Plantation. Under dead wood in bush.

The oviduct contains seven oblately spheroidal white calcareous eggs, measuring approximately 1.0×0.8 mm.

FAMILY PILIDÆ.

Genus **Lanistes** Montfort 1810.

Lanistes libycus (Mor.).

Hab. : Nyong River.

FAMILY CERITHIIDÆ.

Genus **Potamides** Brongniart 1810.

Subgenus **Tympanotonus** Schumacher 1817.

P. (Tympanotonus) fuscatus (L.) and form *radula* (L.).

Hab. : Abonema and Opobo.

Found crawling on the piles of a wharf in creek at Abonema. Enormous piles of the shells are collected and fetch 4/- a barrel. Sold for food in the native markets. A series shows perfect gradation from the stoutly spired typical form to the dissimilar looking *radula*. This is well shown in Pilsbry and Bequaert's recent work on "The Aquatic Mollusks of the Belgian Congo" Plate xx, figs. 1/6. Plate lxvii of the same work shows the extraordinary abundance of this mollusc in certain places. As the upper portion of this species is usually badly eroded or missing I figure a young shell, 35 mm. long, in which all but the extreme tip is in perfect condition—see Plate II, fig. 4.

FAMILY MELANIIDÆ.

Genus **Potadoma** Swainson 1840.

Potadoma nyongensis n. sp. (Plate II, figs. 1/3).

Shell solid, imperforate, straightly-conic, truncate, with $1\frac{1}{2}$ to 2 whorls remaining. White under a dark blackish brown epidermis. Whorls flat, curving out to a strong rounded carina about $\frac{2}{3}$ rds down and continued round the body-whorl at the periphery. On this last whorl are two more carinæ, the upper being a continuation of the lower edge of the whorls whilst the lower bounds the columella region and is heavily calloused and nodulous with a concave area between same and the columella. Aperture bluish-white, oval, angular above and expanding into spouts or gutters at the termination of the peripheral and basal keels. Columella curved and heavily

calloused with white enamel. Surface slightly shining and covered with fine gently curved vertical striæ. Operculum normal.

Size, long. 29, lat. 20; aperture, long. 19, lat. 12 mm.

Hab.: Nyong River.

This species shows much individual variation and approaches, but is distinct from *Potadoma medjeorum* Pils. and Bequaert¹.

Pelecypoda.

FAMILY DONACIDÆ.

Genus **Egeria** de Roissy 1805.

Egeria congica (O. Boettger).

Hab.: Enyong River. Well-grown examples of the smooth form with a single dark ray more or less evident across each valve.

FAMILY MUTELIDÆ.

Genus **Aspatharia** Bourgt. 1885.

Aspatharia sinuata (Mts.).

Hab.: Birrim Riv., Bunso Plantation. Stated to be pearl bearing.

(1) The Aquatic Mollusks of the Belgian Congo, p. 283.

EXPLANATION OF PLATE II.

- 1-3. *Potadoma nyongensis* Spence. No. 1 is the type.
4. *Tympanotonus fuscatus* (L.).
5. *Achatina* (*Leptocala*) *mollicella* (Mor.).
6. *Pseudopeas opoboense* Spence. Type × 7.
- 7-9. *Limicolaria* sp. Used as children's tops.

Cephalopoda landed at Scarborough in 1927.—Quite a record number of species and specimens has been stranded on our shores, caught locally by fishermen and brought to harbour by trawlers during the year. *Eledone cirrosa* (Lk).—Three specimens caught off Hayburn Wyke, six miles N.W. of Scarboro' and Whitby, December, 1926 and October, 1927. *Sepioloa scandica* = *oweniana* Orb. (Steenstrup).—Many specimens brought in on January 17th and 18th, and during the spring. *Loligo forbesi* (Steenstrup).—Several specimens trawled off the Yorkshire Coast. *Sthenoteuthis caroli* (Furtado) a giant specimen measuring 5 ft. 3 ins. cast up in our North Bay, March 18th, 1927, this was only the third specimen known to science. *Rossia macrosoma* (Chiaje) a specimen caught off Hayburn Wyke, November 2nd.—W. GYNGELL.

NON-MARINE MOLLUSCA FROM WEST AFRICA.



1



2



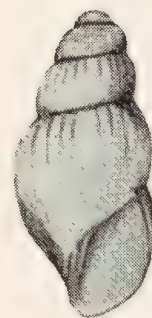
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4



5



6



7



8



9

EXPLANATION OF PLATE II.

- 1-3. *Potadoma nyongensis* Spence. No. 1 is the type.
4. *Tympanotonus fuscatus* (L.).
5. *Achatina* (*Leptocala*) *mollicella* (Mor.).
6. *Pseudopeas opoboense* Spence. Type $\times 7$.
- 7-9. *Limicolaria* sp. Used as children's tops.





Strophocheilus oblongus Müll. Jamaica.

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of Recent Mollusks.**

Founded by **GEORGE W. TRYON, Jr.**, in 1878,
continued by

HENRY A. PILSBRY,

Curator of the Department of Mollusca in the Academy of Natural
Sciences of Philadelphia.

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THE
JOURNAL
OF
CONCHOLOGY.

FOUNDED 1874.

BEING THE ORGAN OF THE CONCHOLOGICAL SOCIETY
OF GREAT BRITAIN AND IRELAND.

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PLATES IV AND V.

LONDON: DULAU & Co., LTD., 32, OLD BOND STREET, W.1.

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PRINTED BY TAYLOR BROTHERS, SOVEREIGN STREET, LEEDS.

NORTH WESTERN NATURALIST

A Scientific and Educational Journal (Published Quarterly) especially for Cheshire, Cumberland, Derbyshire, Isle of Man, Lancashire, North Wales, Shropshire, Staffordshire and Westmorland.

Edited by A. A. DALLMAN, F.C.S.

in Collaboration with

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Editorial—A. A. Dallman, F.C.S., 17 Mount Road, Hr. Tranmere, Birkenhead.

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T H E
JOURNAL OF CONCHOLOGY.

VOL. 18.

AUGUST, 1928.

No. 8.

THE AFFINITIES OF CECILIOIDES AND FERUSSACIA,
ILLUSTRATING ADAPTIVE EVOLUTION.

BY HUGH WATSON, M.A.

(Presidential Address delivered at the Annual Meeting, October 1st, 1927).

PLATES IV AND V.

INTRODUCTION.

THE British Mollusca present many problems of great interest that still await investigation. Gradually, however, we are acquiring sufficient knowledge of the pulmonate forms living in the British Isles to be able to say, at least approximately, what are the general relations of each of our native species. And this is worth knowing, for, after all, our understanding of Nature and of Nature's Laws is mainly founded on our discernment of the ways in which natural objects are related one to another.

But there still remains one British Pulmonate—*Ceciloides acicula* (Müll.)—of which so little is known that it is still a matter of doubt to which even of the main divisions of the Stylommatophora it belongs. Therefore it may be useful if I attempt to elucidate the affinities of this very interesting little snail in the course of this Address, especially as I believe that in doing so I may be able to illustrate principles equally applicable to the study of other Mollusca, whether they be land or fresh-water forms or marine.

It is true that for over a century something more than the shell of *Ceciloides acicula* has been known to science. The absence of eyes in this species was discovered by the elder Férussac more than 120 years ago;¹ and since then Nilsson,² Sordelli,³ Lehmann,⁴ L. E. Adams,⁵ and Wiegmann⁶ have all essayed to add to our knowledge of the outward features or the internal anatomy of the animal. Of these attempts Wiegmann's was the most successful;

¹ "Essai d'un Meth. Conchyl.," 1807, p. 77.

² "Hist. Moll. Sveciae," 1822, pp. 38—40.

³ "Atti Soc. Ital. Sci. Nat., vol. xiii, 1870, pp. 48—50, pl. i, figs. 22—26.

⁴ "Die lebenden Schnecken und Muscheln der Umgegend Stettins und in Pommern," 1873, pp. 128—130, pl. xiii, fig. 43.

⁵ "Journ. of Conch.," vol. ix, 1900, pp. 297—299, text-figs. 1, 2.

⁶ Published by Hesse in "Archiv für Molluskenkunde," vol. liv, 1922, pp. 64—66, pl. i, figs. 11, 15, 17, pl. ii, figs. 12—14, 16, 18.

but he remarked on the great difficulty of investigating the anatomy of so small an animal, in which nearly all the organs are of the same colour; and so many points have remained uncertain that it is not surprising that at the present day some systematists place *Cecilioides* in the Orthurethra and some in the Sigmurethra, some in one family and some in another.

If I am able to throw light on this snail's affinities it is largely owing to the kindness of other members of the Conchological Society. My studies of *Cecilioides acicula* have been mainly based upon a couple of specimens sent to me some years ago by the late Mr. Bacchus, of Bristol, who found them at Cadbury Camp, Tickenham, North Somerset, in the nest of an ant which he identified as *Acanthomyops* (*Donisthorpia*) *flava*. One of these specimens I dissected in the usual manner; the other I sent to Prof. A. E. Boycott, who very kindly cut the animal into 402 thin slices, which he mounted and sent back to me for my contemplation.

I am also much indebted to Major M. Connolly for some examples of *Ferussacia oranensis* Bourgt., which he collected at Oran and kindly identified for me; and to Mr. G. C. Robson, of the British Museum, for specimens of *Ferussacia folliculus* (Gron.) collected by Col. Harkness in Majorca. For as Pilsbry¹ and others² have thought that *Cecilioides* would probably prove to be related to *Ferussacia* Risso, I have had to examine the internal structure of this genus also; seeing that the information hitherto published about its anatomy seems to be as meagre and contradictory as that concerning *Cecilioides* itself, notwithstanding the investigations of Moquin-Tandon,³ Boog Watson,⁴ Godwin-Austen,⁵ and others.

It may be said at once that my researches show that, while *Cecilioides* and *Ferussacia* differ in several rather important respects, yet they undoubtedly do belong to the same family. And if we now consider the various organs in the two genera, I think it will be evident that most of the differences can be explained if we suppose that, in the course of evolution, the genus *Cecilioides* has become specially adapted to an underground habitat.

SHELL.

Figures 2 and 3 on plate iv represent the shell of the species of *Ferussacia* from Oran which I have dissected, and which Bourguignat appears to have named *F. oranensis* sixty years ago. One of the four specimens examined (shown in fig. 3) had a short fold in the upper

¹ "Manual of Conchology" (2nd series), vol. xix, 1908, pp. 211—215

² e.g. Hesse: "Archive für Molluskenkunde," vol. liv, 1922, pp. 67, 70—72.

³ "Journ. de Conchyl." vol. iv, 1853, pp. 345—353; "Hist. Nat. des Mollusques terr. et fluv. de France," vol. ii, 1856, pp. 307—309, Atlas, p. 39, pl. xxii, figs. 20—31.

⁴ "Proc. Zool. Soc." 1875, pp. 677—680, text-figs. 1—5; 1877, pp. 333, 334.

⁵ "Proc. Zool. Soc." 1880, pp. 133, 662—664, pl. lxiv, figs. 1—8.

part of the aperture on the penultimate whorl, in addition to the oblique columellar fold; but in other respects the four specimens closely resembled one another, and clearly belonged to the same species.

The specimens of *Ferussacia folliculus* (Gron.) from Majorca belong to a better known species, the shell of which differs from that of *F. oranensis* in being somewhat broader and more cylindrical in form, with a relatively shorter spire. In both species the shell is light brown and semi-translucent, although fairly solid.

Ferussacia folliculus seems to be closely related to *F. vescoi* Bourgt. and *F. gronoviana* Risso, the type of the genus; and *F. oranensis* differs but little from some of the other North African forms of *Ferussacia* which have been given distinct specific names. But until the numerous named forms of *Ferussacia* found in the Mediterranean region have been compared anatomically, it is difficult to judge how many really distinct species there are. Nevill has remarked on the great variability in the form of the shell which may be observed in a handful of living specimens of *Ferussacia* belonging to a single species, even when taken from under one stone¹; and we have just seen that the presence or absence of a fold in the aperture may be of little specific importance in this genus.

The slender white shell of *Cecilioides acicula* is too well known to require description; even the microscopical spiral striæ that cover its surface did not escape Jeffrey's notice.² But it may be worth pointing out that the young shell has a prominent spiral fold on the upper part of the columella, as shown in fig. 3 on plate v. This fold disappears when the snail is half-grown, but persists until a later stage in one or two of the Continental forms of *Cecilioides*.

The chief differences between the shell of *Cecilioides* and that of *Ferussacia* are that the former is smaller, much narrower, thinner, and destitute of pigment. But to have a small and very slender shell is obviously an advantage to an animal that penetrates into minute crannies in the soil. And pigment would be of no use to such a snail; for the function of pigment in a shell seems to be either to protect the snail from its enemies, by making it inconspicuous in its natural surroundings or easily liable to be mistaken for something else, or to protect the delicate tissues of the animal from the harmful effects of too much unmodified sunlight where the shell is more or less translucent. Clearly a snail living buried in the earth would require it for neither purpose, even if it were able to form pigment under such conditions.

¹ "Proc. Zool. Soc." 1880, p. 133.

² "British Conchology," vol. i, 1862, p. 297.

COLOUR OF ANIMAL.

For similar reasons the skin of *Cecilioides* would not need to be pigmented; and, as a matter of fact, the only trace of colour that can be seen in the head, neck, or foot, when the animal is extended, is the pale brown jaw showing faintly through the tissues.

In *Ferussacia*, on the other hand, the skin is pigmented as usual. It is yellow in *F. oranensis*, tinged with grey on the head; the upper tentacles being dark grey, with a greyish band continued from them along each side of the neck. The greenish coloration of the animal in *F. folliculus* has been described by Moquin-Tandon, who gives a long account of the outward features of this species;¹ while Boog Watson and Godwin-Austen give details about the external appearance of other forms of *Ferussacia*.²

HEAD AND SENSE-ORGANS.

In both genera longitudinal grooves run along the top of the neck and down the front of the head, and both possess the usual two pairs of tentacles, the lower pair being short. But while in *Ferussacia* the upper tentacles bear eyes, which sections show to be as well developed as in most snails, in *Cecilioides* the eyes are entirely absent. Delicate organs like these, however, being easily liable to injury, would be not only useless, but a positive disadvantage, to a snail that burrows in the soil. On the other hand, the large olfactory organs that snails also have in the tips of their upper tentacles are as well developed in *Cecilioides* as in *Ferussacia*, and are capped, as usual, by a discoidal area of columnar epithelium; and it is probably this that has been mistaken by some authors for the front of a colourless eyeball. And inasmuch as the swelling at the tip of a snail's tentacle is formed more by the olfactory organ than by the eye, it is not surprising that L. E. Adams found the upper tentacles of *Cecilioides acicula* to be slightly swollen at their extremities.³

Both genera possess otocysts situated in the usual position on the pedal ganglia (see pl. iv, fig. 7, and pl. v, fig. 2), those of *Cecilioides* having been depicted by Sordelli so long ago as 1870.⁴

FOOT AND ITS GLANDS.

The foot is very similar in the two genera (compare pl. iv, fig. 1, and pl. v, fig. 1). In both the sole is undivided longitudinally, and in both a well-marked foot-fringe is cut off by a conspicuous horizontal groove on each side. Below this groove another much narrower groove runs along the foot-fringe, and forms the limit to which the

¹ "Hist. Nat. des Mollusques terr. et fluv. de France," vol. ii, 1856, pp. 307, 308.

² "Proc. Zool. Soc.," *loci cit.*

³ "Journ. of Conch." ix, 1900, p. 298.

⁴ "Atti Soc. Ital. Sci. Nat.," vol xiii, pl. i, figs. 22-24.

ciliated epithelium of the sole extends. The deep upper groove is joined by a number of oblique grooves, which run down the sides of the foot, and are more numerous in *Ferussacia* than in *Cecilioides*, as might be expected, on account of the larger size of the animal.

The posterior half of the foot is laterally compressed, and appears pointed behind when viewed from above or below. It is keeled dorsally, except beneath the shell in *Ferussacia*, where it is flattened on the top for a considerable distance, doubtless owing to the weight of the shell in this genus.

It has long been known that *Ferussacia* possesses a caudal mucous gland; but in the species examined this seems to consist merely of a slight swelling on the top of the hinder extremity of the foot caused by the unicellular mucous glands that are scattered throughout the skin being more closely aggregated there than elsewhere. This does not appear to occur in *Cecilioides*; but if the mucous secreted by the caudal gland were at all adhesive—as it usually is—it is clear that such a gland would be a great disadvantage to a snail burrowing in the soil.

The animal, however, would require the usual supply of mucous for locomotion; and a well-developed pedal gland occurs in both *Cecilioides* and *Ferussacia*, embedded in the muscles of the foot. The duct of this gland runs forward in the centre of its upper part, broadening anteriorly, and opens above the front end of the sole. In both genera the floor of the duct has a median groove, towards which the necks of the gland-cells converge; and on each side of this groove there is a low, wide ridge, formed of strongly, ciliated, short, columnar cells.

MANTLE-EDGE.

The usual body-lobes are present in *Ferussacia*, the two on the left side being very widely separated, as shown in fig. 8, on plate iv. But, in addition to having these lobes, the edge of the mantle in this genus tends to be reflected for a short distance over the outer surface of the shell, although this tendency is not carried so far in the forms here described as it is in the species found in Madeira.¹ In the embryo of *F. oranensis* and *F. folliculus*, however, the mantle-edge seems to be reflected to a relatively greater extent than in the adult, and bears a posterior tongue-like extension on to the penultimate whorl, resembling that which Boog Watson has described in the Madeiran species (see pl. iv, fig. 4, and text-fig. 1). This suggests that in the ancestors of *Ferussacia oranensis* and *F. folliculus* the mantle-edge was reflected more nearly in the way that it still is in the Madeiran forms. Possibly its reduction may be an adaptation to the

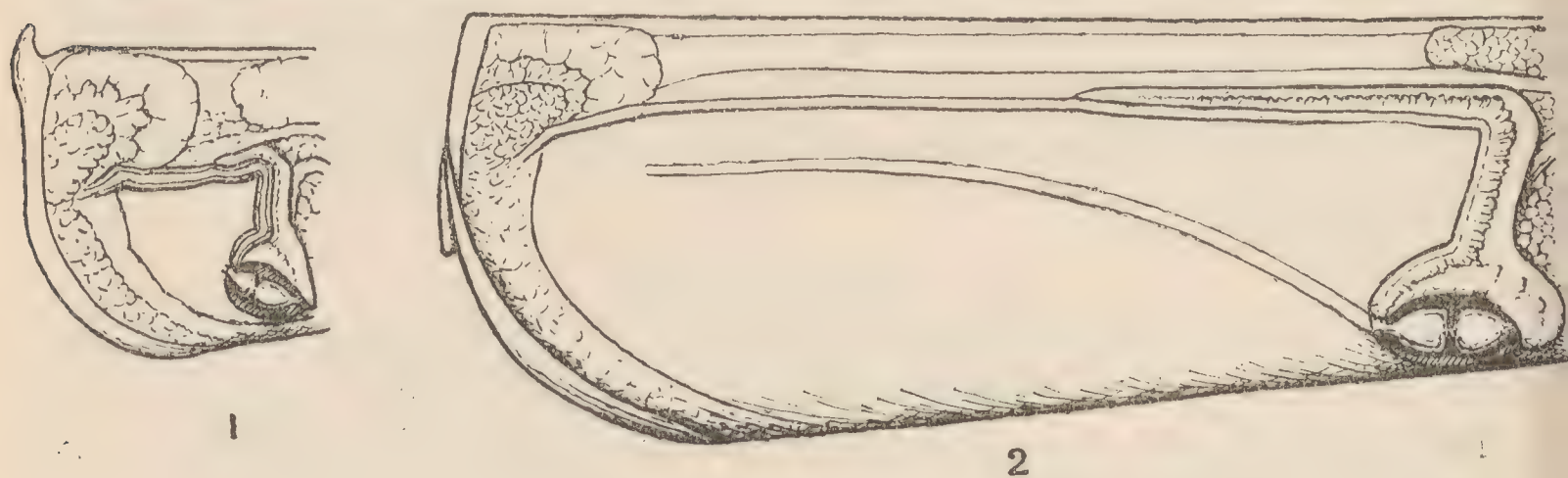
1 Boog Watson: "Proc. Zool. Soc.," 1875, pp. 677-680, text-fig. 1; 1877, pp. 333-334.

drier climate of North Africa and other parts of the Mediterranean region, for extended mantle-lobes must increase evaporation, and are seldom found in snails living in dry regions.

Obviously delicate out-growths like these, extending partly over the shell, would be ill-suited to an animal of underground habits, and they do not occur in *Ceciloides*.

ANAL GLAND.

Both genera have a large gland in the top corner of the mantle-edge, immediately above the respiratory orifice (pl. iv, figs. 4 and 9, pl. v, fig. 7, and text-figs. 1 and 2). In the embryo of *Ferussacia* this gland is relatively quite as large as in the adult snail, in which it measures about 1 mm. in height by at least $1\frac{1}{2}$ mm. in depth (measured backwards from the mantle-edge). It is composed chiefly of very large, thin-walled gland-cells, which discharge their secretions by means of three separate ducts, lined by cubical epithelia. The middle duct is the largest, and opens by a very broad mouth into the upper (or posterior) side of the respiratory orifice at the same place as the anus. One of the two smaller ducts opens close to this wide one, but just behind it, practically within the end of the rectum. The third duct, on the other hand, opens by a slit in the front of the mantle-edge above (or posterior to) the respiratory orifice. (The opening of this duct is shown by a dark line below the upper angle of the mantle-edge in fig. 8, on plate iv).



TEXT-FIGS. 1 AND 2.

External aspect of pallial organs of *Ferussacia folliculus* (Gron.) viewed as flattened out, showing anal gland, kidney, heart, etc.

Fig. 1.—Embryo from uterus, $\times 15$.

Fig. 2.—Adult, $\times 9$.

So far as I am aware, such a highly developed anal gland in this position has not been found in any other Stylommatophora; and its presence, with a similar structure and the same three ducts, in both *Cecililoides* and *Ferussacia*, affords strong evidence in favour of the mutual affinities of these two genera. Possibly the fact that in these genera the whorls of the shell tend to be higher than usual in proportion to their breadth, giving them a somewhat flattened appearance, may be in order to give room for this gland between the other organs and the suture.

The function of this gland cannot be stated with certainty, but perhaps it may serve to keep moist in time of drought the neighbourhood of the respiratory orifice; for aridity is specially inimical to mollusks, and there is some reason to suppose that the group to which these genera belong was evolved in a rather dry region.

RESPIRATORY SYSTEM.

The mantle-cavity, or lung, extends right round the last whorl in *Ceciloides* and *Ferussacia*, when the snail is full-grown; but it is very much shorter in the embryo of *Ferussacia*, as may be seen from the drawings (pl. iv, figs. 4 and 9, pl. v, fig. 7, and text-figs. 1 and 2).

In adult specimens of *Ferussacia* the main pulmonary vein can be seen passing obliquely from the region of the respiratory orifice to the heart, and sometimes some small branches of it can be traced near its anterior end. But there is no distinct vascular network in the roof of the mantle-cavity, and in *Ceciloides* not even the main pulmonary vein can be seen except close to the heart. This, however, is probably connected with the small size of the animal; for in very small snails the tissues are in such close contact with the air that the development of an elaborate vascular system for the adequate aëration of the blood becomes unnecessary.

Moquin-Tandon states that in *Ferussacia folliculus*, when the animal is out of its shell, the heart comes to be situated behind the respiratory orifice, which it seems to shut.¹ It need scarcely be said that in *Ferussacia*, as in *Ceciloides*, the heart always occupies the usual position in the pericardium at the corner of the mantle-cavity furthest removed from the respiratory orifice. The anal gland, however, with its large translucent secretory cells, is very near the respiratory opening, and, in its natural position in the animal, it lies over the region that the pericardium occupies in the penultimate whorl. It seems possible, therefore, that the French author saw the beating of the heart through this semitransparent gland and the intervening walls of shell, and confounded the two organs.

EXCRETORY SYSTEM.

The kidney of *Ferussacia* is very remarkable in form (see pl. iv, fig. 9, and text-fig. 2). Its lower part, next the pericardium, does not extend forward beyond that organ, but it curves down behind it, in such a way as to surround the first part of the aorta. From this region the kidney stretches upward, as a comparatively narrow band, until it reaches the rectum, where it bends abruptly and passes forward immediately beneath the rectum, nearly half way to the mantle-

¹ "Hist. Nat. des Mollusques terr. et fluv. de France," vol. ii, 1856, p. 309. See also "Journ. de Conchyl.," vol. iv, 1853, p. 349, in which Moquin-Tandon states that, according to Saint-Simon, the beating of the heart can be distinctly seen through the pulmonary orifice.

edge, forming a long cul-de-sac. In the embryo, however, this prolongation of the kidney beside the rectum is much shorter than in the adult snail (pl. iv, fig. 4, and text-fig. 1). The internal folds that bear most of the excretory tissue arise almost exclusively from the front wall of the kidney in the vertical part, and from the lower wall in the prolongation towards the mantle-edge.

In *Cecilioides* the upper part of the kidney differs considerably from that of *Ferussacia*, being relatively broader, and curving gradually forward as it approaches the rectum instead of being bent at an abrupt angle where it meets it (pl. v, fig. 7). But fundamentally the kidney seems to be of the same peculiar type as in *Ferussacia*, and the difference may perhaps be explained as due to the narrowing of the whorls—consequent on the underground habits of the animal—having left so little room at the extreme end of the mantle-cavity that the kidney had to be pushed forward a little, and broadened out, in order not to have too narrow an internal cavity to function efficiently. If the kidney had curved forward in the same place in *Ferussacia*, it would have been compressed by the embryos in the uterus.

The unusual extension of the kidney near the rectum in these genera may possibly be explained by the presence of the large anal gland which, when it moves forward with the growth of the mantle-cavity, leaves behind it more space than usual in the upper part of the whorl, and therefore more room for the kidney to extend in that direction than is available elsewhere. For although the shape of the kidney is of systematic value, it is clearly of less physiological importance than its size, structure, blood-supply, and freedom from undue pressure by other organs.

The reno-pericardial canal projects into the kidney from the top of the pericardium, and above the front end of the latter organ the kidney communicates with the ureter by means of a narrow slit. The ureter, which has the form of a closed duct throughout its length, passes upwards and then forwards next to the kidney and the rectum until it reaches the thickened mantle-edge, as may be seen from the drawings (pl. iv, figs. 4 and 9, pl. v, fig. 7, and text-figs. 1 and 2). It then bifurcates; one branch unites with the end of the small duct from the anal gland that opens into the rectum just within the anus on the upper side of the respiratory orifice; the other branch of the ureter crosses obliquely over the outer side of the respiratory orifice and opens immediately below it. This unusual arrangement of the ureter is found in both *Ferussacia* and *Cecilioides*, and affords further evidence in favour of the mutual relations of these genera.

CENTRAL NERVOUS SYSTEM.

The central nervous system is also of the same type in the two

genera, although the visceral loop is shorter in *Ferussacia* than in *Cecilioides*, the pleuro-parietal and pleuro-pedal connectives being considerably longer in the latter genus (see pl. iv, fig. 7, and pl. v, fig. 2). It is very usual, however, to find that the central nervous system has become more concentrated in a larger than in a smaller, related form, doubtless because the greater the distance between the different parts of an animal, the more highly developed must be the apparatus for correlating these parts and conveying stimuli from one to another.

In both genera the right parietal ganglion is united with the abdominal to form a single bilobed ganglion asymmetrically situated on the visceral loop; and in both the cerebral ganglia are somewhat elongated, transversely in *Cecilioides*, obliquely in *Ferussacia*. This is due to the relatively large size of the lateral lobes of the cerebral ganglia in these genera; and it is very interesting to find from sections that these lobes contain a minute flattened cavity towards the outer side, not only in the embryo of *Ferussacia*, but also in adult examples of both genera. This vestigial cavity is a primitive feature found in the lateral lobes of the cerebral ganglia in the Basommatophora and in the Onchidiidæ; but Pelseneer believed that in the Stylommatophora it was found only in the embryo and disappeared completely in the course of development.¹

In *Ferussacia* the connective tissue enveloping the cerebral ganglia contains a few scattered grains of dark pigment, which are more numerous in *F. folliculus* than in *F. oranensis*; but in other respects the central nervous system is very similar in the two species. Although the nervous system of *Ferussacia* and *Cecilioides* was not neglected by Moquin-Tandon and Wiegmann in the same way as the kidney, ureter, anal gland, etc., in both cases their figures² are inaccurate.

DIGESTIVE SYSTEM.

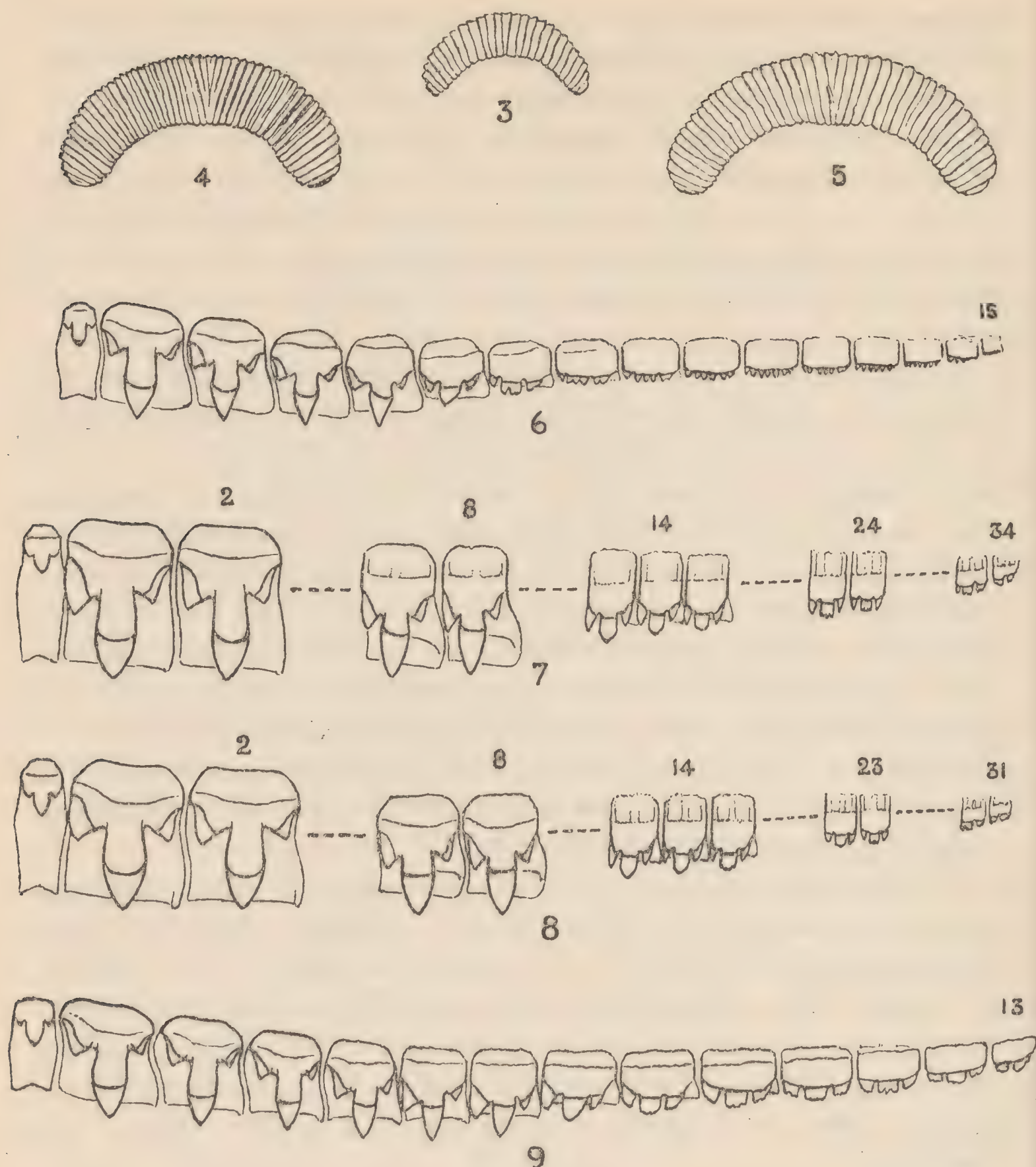
Better drawings of the jaw have been made by Wiegmann³ and Godwin-Austen.⁴ In both genera it is thin and flexible, light brown, rather strongly arched, and crossed by numerous, slightly irregular folds, which denticulate the edges, and which, in *Ferussacia*, converge slightly, so that the middle folds meet at an acute angle in the centre of the jaw (see text-figs. 3, 4, and 5). There are about twenty-six folds in *Cecilioides acicula*, and between forty and fifty in *Ferussacia*, the jaw of *F. oranensis* having rather more numerous and narrower

¹ "Mém. de l'Acad. Roy. de Belg.," vol. liv, 1901, pp. 31-37.

² "Hist. Nat. des Mollusques terr. et fluv. de France," Atlas, 1856, pl. xxii, fig. 24.; and in Hesse: "Archiv für Molluskenkunde," vol. liv, 1922, pl. ii, fig. 18.

³ *Ibid.*, pl. i, fig. 15, pl. ii, fig. 16.

⁴ "Proc. Zool. Soc.," 1880, pl. lxiv, fig. 4.



TEXT-FIGS. 3—9.

- Fig 3. Jaw of *Cecilioides acicula*, $\times 60$.
 " 4. " " *Ferussacia oranensis*, $\times 45$.
 " 5. " " *F. folliculus*, $\times 45$.
 " 6. Radula of *Cecilioides acicula*, $\times 900$.
 " 7. " " *Ferussacia oranensis*, $\times 675$.
 " 8. " " *F. folliculus*, $\times 600$.
 " 9. " " *F. folliculus*, embryo, $\times 900$.

folds than that of *F. folliculus*, as may be seen from my figures. The height of the jaw in *Ferussacia* is .16 mm. in the species examined; its breadth being about .75 mm. in *F. folliculus*, and about .65 mm. in *F. oranensis*. In *Cecilioides acicula* the jaw measures about .075 mm. in height, by very nearly .3 mm. in breadth.

The jaw of *Ferussacia* and *Cecilioides* is thus of the type that is characteristic of the Bulimulidæ, a family found chiefly in South America. Fifty years ago Fischer and Crosse drew attention to this

fact about the jaw of *Cecilioides*¹; but they pointed out that the radula of this genus, on the other hand, resembled that characteristic of the *Stenogyrinæ*, and this is equally true of the radula of *Ferussacia* (see text-figs. 6—9).

In both genera the central tooth is small and narrow, with a short mesocone flanked by a minute vestigial ectocone on each side. In both genera, also, the lateral teeth are tricuspid, with somewhat quadrate basal plates, and with endocones and ectocones that are much shorter than the rather large mesocones. In *Ferussacia* the marginal teeth are also tricuspid, but their cusps—especially the mesocones—become much shorter and squarer, with minute serrations along the cutting edge, which are not due to wear, as they are found equally in the embryonic radula. In *Cecilioides* the cusps on the marginal teeth become so extremely short that the serrations break them up completely into a row of about six or seven minute denticles, which can only be clearly seen under an oil-immersion objective. Some authors have suggested that *Cecilioides acicula* may be carnivorous²; but in carnivorous snails the teeth—especially the marginals—almost invariably have exceptionally long and powerful cusps, the exact opposite to what we find in *Cecilioides*.

The marginal teeth of *Cecilioides* also differ from those of *Ferussacia* in being relatively broader and much shorter, their oblong bases not being lengthened anteriorly in the way in which they are in the latter genus. But we often find that the marginal teeth of small snails tend to be relatively broader and shorter than those of larger, but nearly related, species—a tendency which is not infrequently accompanied by a multiplication of their cusps—and in the embryonic radula of *Ferussacia* the marginal teeth are quite as broad and short as they are in *Cecilioides* (see text-fig. 9). The radula of *Cecilioides acicula* also resembles that of the embryo of *Ferussacia* in that the transverse rows of teeth are slightly angled in the middle, the laterals trending a little backwards on each side of the central tooth.

The radulæ of *Ferussacia oranensis* and *F. folliculus* are very similar, although in the former species the teeth are slightly narrower than they are in the latter. The following are the dimensions and formulæ of the radulæ in the species examined:—

Cecilioides acicula: $\cdot 21 \times \cdot 72$ mm., $(10 + 5 + 1 + 5 + 10) \times 81$.

Ferussacia oranensis: $\cdot 56 \times 1\cdot 5$ mm., $(22 + 12 + 1 + 12 + 22) \times 80(+?)$.

Ferussacia folliculus: $\cdot 62 \times 1\cdot 68$ mm., $(19 + 12 + 1 + 12 + 19) \times 98$.

Ferussacia folliculus, embryo: $\cdot 24 \times \cdot 7$ mm., $(7 + 6 + 1 + 6 + 7) \times 73$.

¹ "Mission Scientifique au Mexique et dans l'Amérique Centrale," Rech. Zool., part 7, vol. i, 1878, p. 588.

² e.g. Jeffreys: "Brit. Conchology," vol. i, 1862, pp. 296, 297.

The length of the buccal mass is about 1.3 mm. in *Ferussacia* and .75 mm. in *Cecilioides*, the posterior extremity of the radula-sac projecting beyond it and curving upwards, as shown in fig. 6 on plate v. In both genera the œsophagus passes backwards from the top of the buccal mass to the stomach, without being enlarged to form a crop. The stomach is capacious, and extends round more than three-quarters of a whorl. The posterior hepatic duct opens into the stomach near the top of its hinder end, and the anterior duct into the base of its hinder end, at the place where it passes into the intestine. This is the case in *Cecilioides* as well as in *Ferussacia*, notwithstanding Wiegmann's figure, from which it might be supposed that the hepatic ducts opened lower down into the intestine.¹ The epithelium lining the intestine is thicker than that lining the œsophagus and stomach, but an internal groove, bordered by a low ridge, runs down the first part of the intestine on one side. After passing downwards and then forwards, the intestine describes the loops shown on the right side of fig. 9 on pl. iv, and of fig. 7 on pl. v, and then continues forwards as the rectum to the anus in the upper wall of the respiratory orifice. Before reaching the mantle-edge, however, the rectum curves slightly downwards in both genera, in order to pass beneath the anal gland (already described); and behind this organ it is often wider than usual.

The salivary glands in *Ferussacia* and *Cecilioides* are rather narrow, and are joined together above the œsophagus towards their hinder ends. The liver consists, as usual, of an anterior division, which the intestine divides into lobes as shown in my drawings, and a posterior division occupying the upper whorls above the stomach. The structure of the liver, however, presents a striking contrast in the two genera. In *Ferussacia* its lobes are sub-divided into numerous small lobules, which cut up the internal cavity of the liver in the usual complicated manner, and the epithelial lining of the short hepatic ducts is much folded. In *Cecilioides*, on the other hand, the small lobules are, to a large extent, flattened out, and the general structure of the liver is greatly simplified, its main cavities being but little sub-divided. Moreover, the walls of both the hepatic ducts are without the usual internal folds. These differences, however, may be attributed to the reduction in the size and breadth of *Cecilioides*, which enables the snail more easily to burrow into small crannies in the soil. For in order to reduce the area of the inner surfaces of the liver in proportion to the reduction in mass of the entire snail, they must be flattened out—unless, indeed, the whole liver were to become smaller compared with the rest of the of the animal; and this is not likely to have taken

1 In Hesse: "Archiv für Molluskenkunde," vol. liv, 1922, pl. ii., fig. 14.

place in a form that has been growing narrower, since the liver occupies the spire, a part that would be less reduced than the body-whorl in a snail becoming more slender. Thus almost the only important difference between the digestive system of *Ferussacia* and that of *Ceciloides* may be explained as due to the latter genus being adapted to an underground habitat.

RETRACTOR MUSCLES.

In most respects the free retractor muscles of *Ferussacia* and *Ceciloides* are very similar, as may be seen by comparing fig. 5 on pl. iv with fig. 5 on pl. v. In both genera the buccal retractor arises from the left cephalic retractor shortly behind its division into the retractors of the upper and lower left tentacles; and in both the retractor of the right upper tentacle passes between the penis and the vagina. But there is one important difference between the retractor muscles of the two genera. In *Ferussacia* the penial retractor arises from the diaphragm (or floor of the mantle-cavity), as it does in the majority of the Stylommatophora, and as Wiegmann states that it does in *Ceciloides acicula*.¹ But in both of the specimens of this species which I have examined the penial retractor arises as a branch of the muscle that stretches from the columella to the hinder-part of the foot, as shown in my drawing on pl. v.

Possibly this unusual origin of the penial retractor in *Ceciloides acicula* may be a consequence of the slender form of this burrowing snail. In its natural position the penial retractor, if it arises near the hinder end of the diaphragm, must pursue a somewhat spiral course, like the other retractor muscles; and the narrower the body-whorl becomes, the more closely will its central part be approximated to the other muscles near the columella. If this should lead to the middle of the penial retractor coming into permanent contact with the muscle from the columella to the hinder part of the foot, the two muscles might easily grow together where they were contiguous; and if this occurred, the posterior half of the penial retractor, between the diaphragm and the point of union, would then be superfluous and might be expected to disappear.

GENITAL SYSTEM.

If one examines an adult specimen of *Ferussacia*, a black line will be noticed running round the first quarter of the third whorl of the shell (see fig. 1 on pl. iv). This is caused by the hermaphrodite gland or ovotestis, which, in both species examined, consists of a single row of about six or eight rather small follicles covered with black pigment, and therefore contrasting strongly with the adjacent liver

1 In Hesse : *op. cit.*, p. 64.

(see text-fig. 10, and pl. iv, fig. 5).¹ The comparatively small size of this important gland may be correlated with the fact that *Ferussacia* is viviparous, or at least ovoviviparous; for, as there is not room for many embryos in the uterus at one time, it would seem superfluous for the animal to have an ovotestis big enough to form a large number of ova simultaneously. The secretion of a thick layer of pigment instead, to give adequate protection to a smaller number of ova, would appear to be of more use.

Owing to the narrowing of the shell in *Cecilioides*, we might expect the number of follicles of the ovotestis to be reduced in this genus; but it is surprising to what an extent this reduction has actually taken place. Sections of *Cecilioides acicula* show that in this species the gland consists of only a single large unpigmented follicle, as shown in fig. 5 on pl. v.

In both genera the hermaphrodite duct becomes convoluted towards its anterior end, the convolutions being most developed in *Ferussacia folliculus*; and this part of the duct is also slightly swollen in *Ferussacia* and much more so in *Cecilioides*, doubtless functioning as a vesicula seminalis, an organ which is not otherwise developed in either genus. The hermaphrodite duct becomes narrower again at its anterior extremity in both genera, bending backwards for a short distance and then abruptly forwards again as it becomes embedded in the large albumen gland.

In *Cecilioides acicula* the genital duct, immediately after receiving the duct of the albumen gland, becomes enlarged to form a spermoviduct of normal character. The walls of the female part of the spermoviduct are swollen with translucent gland-cells; while the male part is represented by a narrow internal groove passing down one side, into which open the tubules of the prostate gland, which is well developed in this genus, covering the side of the spermoviduct, as may be seen from the drawing (pl. v, fig. 5). The free oviduct, between the separation of the vas deferens and the opening of the receptacular duct, is comparatively short. The spermatheca is a small oval sac, about .2 mm. long, lying against the spermoviduct towards its anterior end, and borne by a simple, rather slender duct, about .35 mm. in length. The oviduct passes straight forward as a rather long vagina (about .5 mm. in length) to the small genital atrium opening on the right side of the head.

Cecilioides is oviparous, and Folin and Berillon have figured a specimen containing an egg,² but the spermoviduct does not usually

¹ The peculiar black appearance of the ovotestis was noticed by Godwin-Austen in two of the specimens of *F. gronoviana* Risso, which he examined ("Proc. Zool. Soc.," 1880, p. 663, pl. lxiv, fig. 6).

² "Bull. Soc. de Borda," Dax, 1877, "Contrib. Fauna Malac. S-O. de la France," iii, p. 29, pl. iii, fig. 3.

contain eggs, as it so often does in the Stenogyrinæ. *Ferussacia*, on the other hand, is viviparus, and all the specimens I have examined contained two, three, or four large embryos (pl. iv, fig. 4), which were not enclosed in any egg-shells. Moquin-Tandon, however, states that, although he found two young snails in the uterus of one specimen of *F. folliculus*, two other individuals each contained six or seven eggs, which suggests that this species, at least, would be more correctly termed ovoviviparus, as he maintains.¹ The embryonic shells of *Ferussacia oranensis* consist of $2\frac{1}{4}$ whorls, and those of *F. folliculus* of about 2 whorls; and in both species they attain a size of about 1 mm. broad by 1.75 mm. high. Clearly the development of such relatively large embryos in the spermoviduct would have been impossible in a form with so narrow a body-whorl as *Cecilioides acicula* has come to possess in adaptation to its habits.

In the Stylommatophora the cavities of the male and female ducts seldom become separated behind the anterior end of the spermoviduct; but they do so in two or three viviparous genera, such as *Partula*,² doubtless because the pressure of the growing embryos might otherwise flatten out and completely block the spermatic groove inside the spermoviduct. And sections of *Ferussacia oranensis* show that the male and female parts of the spermoviduct are separate from the point where the duct of the albumen gland opens into its posterior end. The female part then enlarges greatly to form the capacious, thin-walled uterus; and the male part forms a slender duct which runs forward attached to the uterine wall, and bears through its entire length a fringe of small prostatic tubules, the prostate gland being much narrower in *Ferussacia* than in *Cecilioides* (see text-fig. 10, and pl. iv, fig. 5). The spermoviduct narrows abruptly at its anterior end, and here there is a short communication between the male and female ducts before the male one becomes detached to form the vas deferens.

The female duct in *Ferussacia* then continues forward as the so-called free oviduct, which is longer than in *Cecilioides*, but rather narrow, though the epithelium lining it is much folded longitudinally, in order to allow for the enormous increase in the breadth of the duct that must take place when the embryonic snails pass down it.

The spermatheca is oval, and lies against the spermoviduct towards its anterior end; it is about .4 mm. long in *Ferussacia oranensis* and somewhat less in *F. folliculus*. The unbranched receptacular duct is considerably longer than in *Cecilioides acicula*, and is divisible into two parts: a slender posterior portion, about 1.3 mm. long, with an

¹ "Hist. Nat. des Mollusques terr. et fluv. de France," vol. ii, 1856, p. 308.

² Pilsbry: "Manual of Conchology" (2nd series), vol. xx, 1909, p. 160.

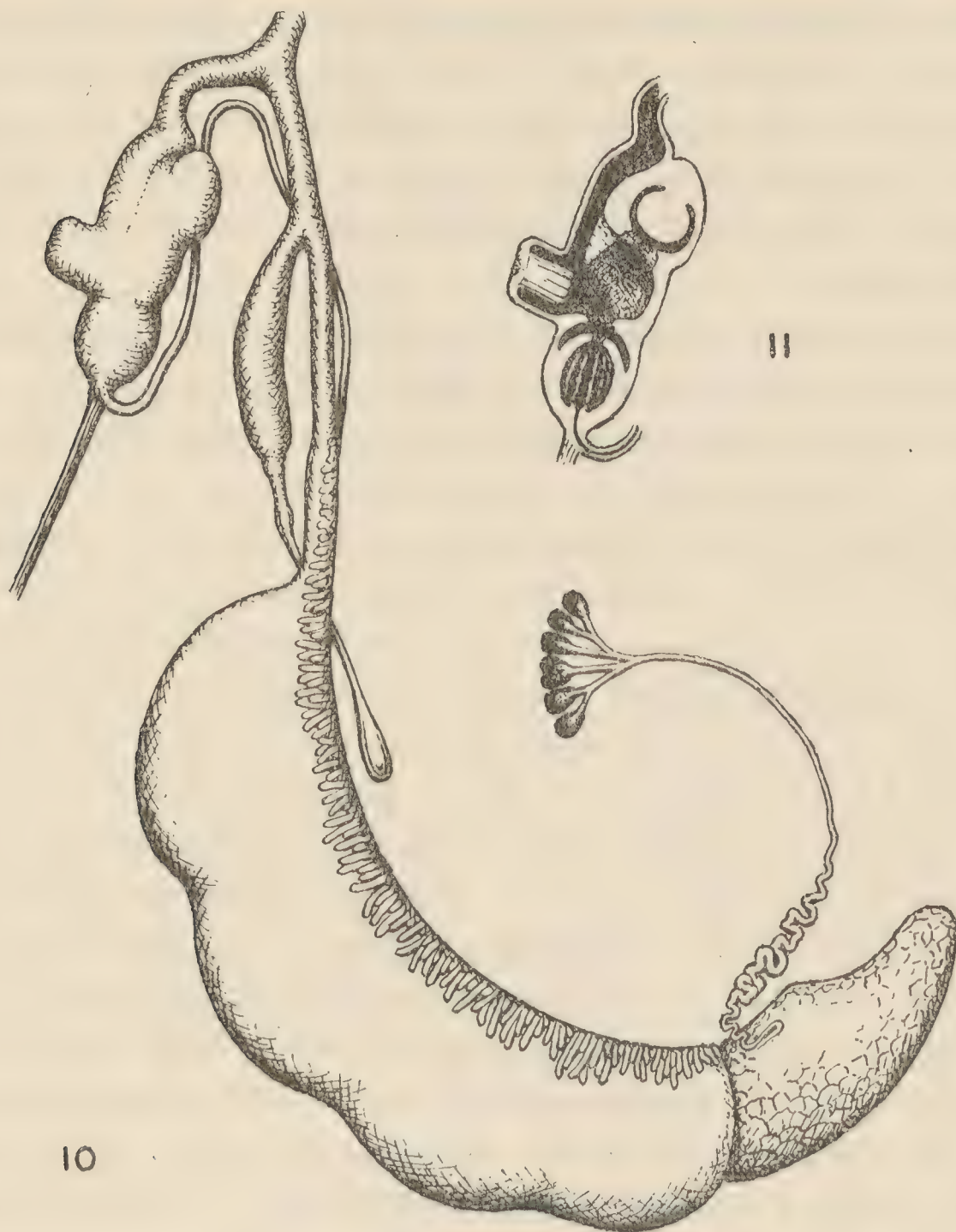
incipient tendency to be convoluted near its front end, and a thick muscular anterior portion, which is about 1.2 mm. long in *F. folliculus*, and about .75 mm. long in *F. oranensis*, being much broader and shorter in the latter species than in the former. In *F. oranensis* a broad muscular longitudinal fold projects into the cavity of this anterior portion of the receptacular duct, except towards its front end, where we find a number of irregular longitudinal folds covered with microscopical papillæ. This muscular part of the receptacular duct is also folded internally in *F. folliculus*. In front of the opening of the receptacular duct the vagina is about .75 mm. long in both species of *Ferussacia*, and passes straight forward to the genital atrium, which is slightly longer than in *Ceciloides*, and opens a short distance behind and below the base of the right upper tentacle, in the position shown in fig. 1 on plate iv.

In both genera the vas deferens passes forward near the female duct, and then bends round under the right tentacular retractor and passes backwards and upwards beside the penis, to enter this organ at its posterior extremity, where the penial retractor is also inserted. The vas deferens is not enlarged to form an epiphallus, but in *Ferussacia* its epithelial lining appears to be surrounded by a rather thick layer of circular muscle-fibres.

The penis of *Ferussacia oranensis* is shown in figs. 5 and 6 on pl. iv, and is rather complex in structure. Its hinder end forms a kind of wide muscular knob, which contains what may be regarded as a broadened penis-papilla, the outer walls of which have become united, except near the front, with the surrounding walls of the penis itself, while the lining of its cavity is longitudinally folded. In front of this broad papilla's anterior end there is a constriction, beyond which the penis and its cavity widen considerably. Into the right side of this part of the penis there opens a broad and short muscular appendix, directed forwards and downwards, and ending in a slight knob containing a spheroidal muscular papilla. The penis itself is continued, as a rather narrow, thin-walled tube, along the left side of the appendix, to which it is closely attached, and then beyond it to the genital atrium. The penis is 1 mm. long from its posterior end to the front end of the appendix, and the narrow part in front of this is about .4 mm. in length; but clearly this part must sometimes be greatly shortened and widened to allow the muscular parts of the penis and its appendix to be everted through it.

In most respects the penis of *Ferussacia folliculus* resembles that of *F. oranensis*; yet it shows certain marked differences, as may be seen from text-figs. 10 and 11. The proximal part of the muscular appendix is smaller, but its terminal knob is larger and more promin-

ent, and contains a larger spheroidal papilla. Moreover a second appendix projects almost at right angles from the left side of the penis, opposite to the posterior (or proximal) end of the muscular appendix already mentioned. This second appendix has thin walls, and is very short, having a peculiar truncated appearance, owing to its end being invaginated into its cavity, as shown in the section (text-fig. 11).



TEXT-FIGS. 10 AND 11.

Ferussacia folliculus (Gron.).Fig. 10. Genital organs, $\times 15$.,, 11. Longitudinal section of posterior half of penis, $\times 20$.

While the muscular appendix found in both species evidently has a copulatory function, serving for stimulation or retention, it is difficult to understand what is the purpose of the second thin-walled appendix occurring in *F. folliculus*. It is possible, however, that when the penis is being everted and its walls turned inside out, this appendix may serve temporarily to accommodate the muscular one until it also has become everted.

The penis of *Cecilioides acicula* bears a general resemblance to the type found in *Ferussacia*, consisting of a broad, muscular, posterior

part, .6 mm. long, with a slight constriction behind the middle, and a slender, thin-walled anterior part, about .45 mm. in length (see pl. v, fig. 5). But the structure of the penis is far simpler in this genus (see pl. v, fig. 4). Yet in the terminal part, behind the slight constriction, it is still possible to make out what I regard as the penis-papilla, though its walls have become more completely united with the surrounding walls of the penis itself. And further forward the cavity of the penis extends on the right side into a pocket in its muscular walls, which is probably homologous with the appendix found on the right side of this part of the penis in *Ferussacia*, though the pocket is not directed forwards, nor does it contain any spheroidal papilla.

Thus the genital organs of *Ceciloides* may be regarded as a simplified version of those of *Ferussacia*. When a publisher wishes to produce a pocket edition of a book he can reduce the size of the print, and the thickness of the paper and covers; but he cannot do this indefinitely if the book is to remain legible and serviceable; a time comes when he must also abridge the text, abbreviating or cutting out any appendices or other portions, which, though perhaps interesting in themselves, are not really necessary to the main purpose of the work. Similarly, when, in the course of evolution, a snail is to be adapted to burrowing into narrow pockets in the soil, much can be done by merely reducing the size of the various organs, and the breadth and thickness of the shell. But this cannot be done indefinitely without impairing the efficiency of some of the vital organs; and a time comes when it is necessary, in order to leave room for these, to abbreviate or cut out altogether some of the genital appendices or other structures, which, though possibly stimulating in function, are not necessary to the survival of the species. If I am not mistaken, something of this kind has probably happened in the evolution of *Ceciloides*, for the internal structure of its male organs suggests that their comparative simplicity has been, to at least some extent, secondarily acquired.

It will have been seen that my description and drawings of the genital ducts in *Ferussacia* agree neither with those of Moquin-Tandon,¹ nor with the very different account given by Godwin-Austen.² It is possible that these discrepancies may be partly owing to specific differences in the forms examined; but I suspect that they are chiefly due to errors of observation on the part of the earlier authors. Lehmann's figure of the genital system of *Ceciloides acicula*³

¹ "Journ. de Conchyl," vol. iv, 1853, pp. 349, 352, 353; "Hist. Nat. des Mollusques terr. et fluv. de France," vol. ii, 1856, p. 309, Atlas, p. 39, pl. xx, fig. 26.

² "Proc. Zool. Soc.," 1880, p. 663, pl. lxiv, fig. 7.

³ "Die lebenden Schnecken und Muscheln der Umgegend Stettins und in Pommern," 1873, pl. xiii, fig. 43.

is certainly inaccurate. On the other hand Wiegmann's description and drawings of these organs¹ prove to be substantially correct, although he describes and figures the receptacular duct as being shorter than I have found it. He also shows the anterior, thin-walled part of the penis to be shorter and broader than it is in my specimens, especially in one of the two individuals that he examined; but this is the condition that it must always assume when the penis is about to be everted.

MUTUAL RELATIONS OF *CECILIOIDES* AND *FERUSSACIA*.

It will be evident from the above account that the genera *Cecilioides* and *Ferussacia* possess many features in common. Thus they resemble each other, and differ from many other genera with somewhat similar shells, in having a well-defined foot-fringe, a large and elaborate anal gland, a sigmurethrous kidney prolonged beside the rectum and with an anteriorly bifurcated ureter, a Bulimuloid jaw combined with a typically Stenogyroid radula, and a penis divisible into a slender, thin-walled, anterior portion and a broad, muscular, posterior part, with a short lateral appendix or pocket. Clearly the two genera belong to the same family.

Yet, in addition to the absence of eyes and other external distinctions, we have seen that *Cecilioides* differs from *Ferussacia* in several features of its internal anatomy, such as the shape of the upper part of the kidney, the marginal teeth of the radula, the structure of the liver, the origin of the penial retractor, the ovotestis, the spermovoduct and receptacular duct, and the simpler penis. In view of all these differences, the question arises whether we should not follow the example of Fischer and Crosse² and place these two genera in separate subfamilies. On the whole I do not think it is necessary to adopt this course, partly because it is not unlikely that some of the forms that have not yet been dissected, such as the species of *Hohenwartiana*, may prove to be intermediate in their anatomy, and partly because, as I have attempted to show, nearly all the most striking differences between the two genera may be reduced to one, namely, that *Cecilioides* has become adapted to an underground habitat, and that *Ferussacia* has not. We conclude, therefore, that the two genera are nearly related, and have sprung from a common ancestor; but that owing to its underground habits *Cecilioides* has acquired a number of new characters adapting it to its environment, and has been prevented from acquiring other features which *Ferussacia* has developed in the course of its further evolution.

¹ In Hesse: "Archiv für Molluskenkunde," vol. liv, 1922, pp. 64 and 65, pl. i, fig. 11, pl. ii, figs. 12 and 13.

² "Mission Scientifique au Mexique et dans l'Amérique Centrale," Rech. Zool., part 7, vol. i, 1878, pp. 585 and 587.

OTHER NEARLY RELATED GENERA.

Pilsbry provisionally placed eight other genera in the same family as *Ferussacia* and *Ceciloides*¹ (in addition to *Geostilbia*, which he regards, perhaps rightly, as only a subgenus *Ceciloides*²). Among these :—

Hohenwartiana Bourgt. will probably prove to be closely related to these two genera, although at present nothing seems to be known about either the pallial or the genital organs of this genus, Pollonera having merely figured the radula and noted the presence of a caudal mucous gland.³

Calaxis Bourgt. will also probably prove to belong to the same group, notwithstanding the very different form of the marginal teeth of the radula, as figured by Thiele.⁴ This modification of the radula seems to indicate that *Calaxis* has acquired carnivorous tastes; but apparently some species of *Ferussacia* may also be carnivorous occasionally, when unable to obtain vegetable food.⁵

Cryptazeca Folin & Berillon should prove to be closely allied to *Ferussacia*, judging from the original figures of the outward appearance of the animal, as well as of the shell.⁶ Moreover Barrois has shown that the structure of the caudal mucous gland possessed by this genus resembles what I have found in *Ferussacia*.⁷ On the other hand, Barrois' figures and description of the pallial and other organs are difficult to reconcile with any such relationship.⁸ But this writer evidently misidentified some of the organs, and it would seem best to attach little weight to his observations until some one has made a new examination of this interesting form from the South-West of France.

Digoniaxis Jouss. may also belong to this group, although the affinities of this rather peculiar form must remain doubtful until we know something of its anatomy.

On the other hand, I should be surprised if *Coilostele* Bens. proves to be very closely related to *Ferussacia* and *Ceciloides*. The characters of the shell suggest that this genus might equally well

1 "Manual of Conchology" (2nd series), vol. xix, 1908, pp. 211-215.

2 That *Ceciloides* (*Geostilbia*) *gundlachi* Pfr. is blind like *C. acicula* has been known since 1856 (Poey: "Mem. Hist. Nat. Cuba," vol. ii, p. 57); and Binney & Bland have figured the jaw and radula ("Ann. Lyceum Nat. Hist. N. York," vol. xi, 1875, pp. 152, 185, pl. xiii, figs. D, G, H, and I).

3 "Bull. Soc. Mal. Ital.," vol. xii, 1887, p. 110, pl. iv, fig. 30.

4 "Archiv für Molluskenkunde," vol. liii, 1921, pl. iv, fig. 3.

5 Moquin-Tandon: "Journ. de Conchyl." vol. iv, 1853, p. 352.

6 "Bull. Soc. de Borda," Dax, 1877, "Contrib. Fauna Malac. S.-O. de la France," iii, pl. iii, figs. 4 and 5.

7 *Ibid.*, p. 18, pl. iv, figs. 4 and 5.

8 *Ibid.*, pl. iv, fig. 7, etc.

belong to the Stenogyrinæ, a view that would be no less consistent with what Thiele¹ and Hesse² have published about its radula.

And *Glessula* v. Martens is certainly more nearly allied to the Stenogyrinæ than to *Ferussacia* and *Cecilioides*, from which genera it differs widely in its pallial organs, etc., as I have convinced myself from an examination of a specimen of *Glessula*, from Ceylon, preserved in the Cambridge University Museum of Zoology.

AFFINITIES WITH *COCHLICOPA*, *AZECA*, AND OTHER ORTHURETHRA.

The remaining two genera that Pilsbry provisionally grouped with *Ferussacia* and *Cecilioides* are *Cochlicopa* Fér. and *Azeca* Leach in Turton; and as these are orthurethrous genera, related to *Ena* and *Amastra*, he placed the whole family in the Orthurethra.³ Hesse also places *Cochlicopa* and *Azeca* in the same family as the genera we have been considering,⁴ but he improves upon Pilsbry's classification by putting them in a separate sub-family, in which he also places a third genus, *Spelæoconcha* Sturany, which Wagner has shown to be probably related to *Azeca*.⁵

But *Ferussacia* and *Cecilioides* differ widely from *Cochlicopa*, *Azeca*, and other Orthurethra in many respects, and not least in their pallial organs, as will have been evident from the account I have given. Certainly they should not be placed in the same family. Indeed, not only do the genera *Ferussacia* and *Cecilioides* undoubtedly belong to the Sigmurethra, but the type of kidney and ureter that they possess departs further from the orthurethrous type than does that of any other group of sigmurethrous snails with well-developed shells at present known to science. This is worth emphasising, because Thiele has upheld the view that different families of the Sigmurethra may have been independently evolved from the Orthurethra, and that *Ferussacia* and its allies may form a transition between the Orthurethra and such sigmurethrous families as the Achatinidæ,⁶ which is certainly very far from being the case.

AFFINITIES WITH THE ZONITIDÆ AND ENDODONTIDÆ.

Pilsbry⁷ and others have suggested that *Ferussacia* may be related to the Zonitidæ, Endodontidæ, and other families of the Aulacopoda, if it be not an orthurethrous form, seeing that it has a definite foot-fringe and a caudal mucous gland. Moreover, the reflected mantle-edge in *Ferussacia* recalls the condition found in many Zonitidæ, and in

1 "Archiv für Molluskenkunde," vol. liii, 1921, p. 152.

2 *Ibid.*, vol. lix, 1922, p. 68.

3 "Manual of Conchology," *loc. cit.*

4 "Archiv für Molluskenkunde," vol. liv, 1922, pp. 70-73.

5 "Sitz-Ber. Kais. Akad. d. Wiss., Math-naturw. Klasse, vol. cxxiii, part 1, 1914, pp. 43-45.

6 "Archiv für Molluskenkunde," vol. liii, 1921, pp. 151-154.

7 *Op. cit.*, p. 212.

some members of the Endodontidæ the radula is not unlike the type found in the genera with which we have been dealing.¹

But while it may be admitted that *Ferussacia* and *Cecilioides* are more nearly allied to these families than to any of the Orthurethra, I do not believe that the relationship is at all close. The shell is of an entirely different type in these genera. The reflection of the mantle-edge in *Ferussacia* and in various Zonitidæ is almost certainly due to parallel evolution. And I believe that this is also true of the resemblance of the foot. A foot-fringe is sometimes developed in other families of the Sigmurethra besides those belonging to the Aulacopoda; and the foot-fringe of *Ferussacia* and *Cecilioides* is not altogether homologous with that of the Zonitidæ and Endodontidæ. In these families the fringe is covered with the ciliated epithelium of the foot-sole up to the conspicuous peripodial groove that forms the upper limit of the fringe. In *Ferussacia* and *Cecilioides*, on the other hand, we have seen that the ciliated epithelium does not extend over the entire foot-fringe, but ends abruptly in a narrow groove that runs along the side of the fringe dividing it into a lower and an upper portion. Thus the conspicuous groove that cuts off the foot-fringe in these genera does not correspond to the peripodial groove of the Zonitidæ and Endodontidæ, but to a second, more irregular groove which sometimes is found above the peripodial groove in these families; and the foot-fringe of the Aulacopoda is therefore only homologous with the lower part of the fringe in the genera that we have been considering.

AFFINITIES WITH THE ACHATINIDÆ.

Most of the older authors included *Cecilioides* and *Ferussacia* in the Achatinidæ, *C. acicula* having been for many years included in the genus *Achatina*; and although both genera differ widely from *Achatina* itself I think that they are more closely related to the Achatinidæ than to any of the other families of the Sigmurethra, and have probably sprung from primitive members of this family.

Ferussacia and *Cecilioides* resemble some of the Stenogyroid genera of the Achatinidæ particularly closely in their radulæ—more closely than they do any of the Endodontidæ with which I am acquainted. A foot-fringe is also developed in some genera of the sub-family Stenogyrinæ, and even a caudal mucous gland in *Pseudoglessula* and *Krapfiella*. The lower part of the kidney in *Opeas* and its allies approaches that of *Ferussacia* and *Cecilioides* in not stretching forwards beside the main pulmonary vein to the extent to which it does in the majority of the Achatinidæ. There is, moreover, a general resemblance

¹ Compare my figure of the radula of *Helicodiscus lineatus* ("Proc. Malac. Soc.," vol. xiv, 1920, p. 12, fig. 4e) with that of *Cecilioides acicula* (text-fig. 6, on p. 226 of this address).

in the central nervous system and in the female genital ducts, and also in the shell of at least some forms.

On the other hand, the kidney in the Achatinidæ never seems to extend forwards beside the rectum as it does in *Ferussacia* and *Cecilioides*; an elaborate anal gland, like these genera both possess, is not developed; the jaw is striated instead of being folded; and although the male organs show a considerable diversity among the smaller Stenogyrinæ and are in some cases rather complicated, in none of the genera that I have studied do they approach the type found in *Ferussacia* and *Cecilioides*. It therefore seems probable that the common ancestor of these genera separated from the Achatinidæ at a comparatively early stage in the evolution of that family; and I am inclined to think that they may be regarded as having diverged from it just far enough to be placed in a distinct family, according to the present standards of classification. For this family the name Ferussaciidæ¹ may be retained; and although it does not occupy the systematic position that Pilsbry gave it, probably more than half the genera that he placed therein, "as a temporary arrangement, pending more exact knowledge,"² will be found to be correctly assigned to it, namely, *Ferussacia*, *Cryptazeca*, *Hohenwartiana*, *Cecilioides*, *Calaxis*, and probably *Digoniaxis*.

AFFINITIES WITH THE OLEACINIDÆ AND TESTACELLIDÆ.

More than one author has suggested that *Ferussacia* may be related to the Oleacinidæ, and in 1852 the species of this genus were placed by Morelet in *Glandina* (or *Oleacina*) itself.³ Certainly the conchological resemblance is very striking, but this is undoubtedly mainly due to parallel evolution. The anatomy of the Ferussaciidæ shows that the family is more closely allied to the Achatinidæ than to the Oleacinidæ.

Some years ago, however, I advanced the view that the Oleacinidæ had sprung from the same stem as the Achatinidæ and the Megaspiridæ⁴—a view with which Thiele concurs⁵—and, if this be so, the Ferussaciidæ have indeed an indirect relationship with the Oleacinidæ.

Several members of the Oleacinidæ possess a lateral penial appendix, which may be homologous with that found in *Ferussacia*;

¹ Pilsbry adopts the spelling "Ferussacidæ," but Hesse spells the name "Ferussaciidæ," which seems preferable and more in accordance with the International Rule on the formation of the names of families. On the other hand, Hesse follows Pilsbry in spelling the generic name of *C. acicula* "*Cæcilioides*." But when Férussac founded the genus he spelt the name "*Cecilioides*," (Mém. Géolog. 1814, p. 48), and in the case of generic names the International Rules state that the original spelling must not be altered unless it clearly contains a misprint or an error of transcription or a slip of the pen, and in the present instance there seems to be no evidence that Férussac did not intend the name to be spelt in the way it was printed.

² *Op. cit.*, p. 212.

³ "Journ. de Conchyl.," vol. iii, pp. 27-41.

⁴ "Annals Natal Museum," vol. iii, 1915, pp. 250-254.

⁵ "Archiv für Molluskenkunde," vol. liii, 1921, p. 155.

but the tendency to form such an appendix is probably a primitive character, which would be present in the common ancestors of the Oleacinidæ and Achatinidæ, and may well have been possessed also by the early members of the latter family from which I believe the Ferussaciidæ to have sprung, even if it were subsequently lost in the further evolution of the Achatinidæ, although I have found a terminal penial appendix in some of the living Stenogyrinæ.

If the family Ferussaciidæ is thus indirectly related to the Oleacinidæ, it is probably also related indirectly to *Testacella*, for I have shown that there are good grounds for believing that this genus has been evolved from the Oleacinidæ,¹ a view that has recently been accepted by Hoffmann.² If this be so, it follows that—while the species of *Opeas* and *Subulina*, introduced into hot-houses in this country, are the nearest allies to *Cecilioides* now living in Britain—among our native British species the one that is most closely related to *Cecilioides* is *Testacella maugei* Fér.,³ the most primitive of our species of *Testacella*.

GEOGRAPHICAL DISTRIBUTION.

Testacella resembles *Cecilioides* in being adapted to an underground existence, although not to the same extent nor in quite the same way. It is possible that this is not a mere coincidence. If I am not mistaken in the views expressed above, *Testacella* and *Cecilioides* differ from most of the British Pulmonata in having sprung from a group of snails found abundantly in tropical and sub-tropical regions. In early Tertiary times, when a warmer climate prevailed in Britain, other genera of this group occurred in England, but they disappeared from these latitudes with the gradual approach of the Glacial Period, probably because they could not stand the cold. The underground habits of *Cecilioides* and *Testacella*, however, would afford them no little protection from the frost, and this may be why these two genera are now found in the British Isles.

Probably the underground habits of the species of *Cecilioides* would also protect them to some extent from desiccation in times of drought; and perhaps this is the reason why the genus has been able to spread from the Mediterranean Region southward and eastward into the Ethiopian and Oriental Regions, through areas which seem to have long possessed a climate sufficiently dry to form a barrier to most genera of the Stylommatophora. But this does not explain the presence of *Cecilioides* in Central America and the West Indies, which is almost certainly due to the genus having been evolved before the New World was completely cut off by the Atlantic Ocean.

¹ *Op. cit.*, pp. 238-248

² "Archiv für Molluskenkunde," vol. lvii, 1925, pp. 213-217.

³ For nomenclature of this species see "Naturalist," 1921, pp. 401-403.

It must not be forgotten, however, that the occurrence of *Cecilioides* in certain remote localities may be due to the agency of man. Small snails, living buried in the soil, are especially liable to be transported among the roots of plants, etc.—indeed, even so large a form as *Testacella maugei* seems to have been thus transported to the Cape and to New Zealand, and there given new names. It is therefore not surprising that some of the specimens of *Cecilioides* that have been described from South Africa appear to represent colonies of *C. acicula* which have doubtless been introduced from Europe; while *C. (Geostilbia) gundlachi* Pfr., a species originally from the Antilles, seems to have been introduced by man, not only into tropical Africa, but also into the Philippines, the Hawaiian Islands, and New Caledonia.¹

The distribution of the remaining genera of the Ferussaciidæ scarcely extends beyond the boundaries of the Mediterranean Region and the Atlantic Islands; for I agree with Pilsbry² in believing that the single species of *Ferussacia* found in Mauritius (of which Semper has described the radula and jaw³) is probably an importation from southern Europe. It is just possible, however, that one or two forms from the West Indies and Central America now placed in the Oleacinidæ, such as *Peteniella* Pilsbry, many prove to belong to the Ferussaciidæ when their anatomy has been studied.

There is a striking similarity between the geographical distribution of the Ferussaciidæ, on the one hand, and the Oleacinidæ with *Testacella*, on the other. Both groups seem to be restricted to the same regions on each side of the Atlantic, except that in both a single genus of underground habits has acquired a more extended distribution in the Old World. But whereas the latter group includes numerous forms from Central America and the West Indian Islands, and only a few from this side of the Atlantic, the family Ferussaciidæ includes a number of species from the Mediterranean Region and the Atlantic Islands, but only a few from the transatlantic area in which the species belonging to the Oleacinidæ are so much more abundant. Thus the evidence suggests that both were developed in Mesozoic times in a land area which then united the two regions in which they both occur, but that the centre of distribution of the Ferussaciidæ was further east than that of the Oleacinidæ.

If the Ferussaciidæ have been evolved from early members of the great tropical family Achatinidæ, and have passed northwards to the region in which they now chiefly occur, they must almost certainly have traversed at one time an area in which the climate was drier than

¹ Pilsbry and Bequaert: "Bull. Amer. Mus. Nat. Hist., vol. liii, 1927, p. 460.

² "Manual of Conchology" (2nd series), vol. xix, 1908, p. 233.

³ "Reisen im Archipel Phil.," Landmoll., vol. iii, 1874, p. 135.

that of the Tropics ; for although the climate of the zones immediately to the north and south of the Tropical belt has fluctuated in the past from various local causes, it must have been drier, on an average, than that of the Equatorial zone ever since the Poles have occupied approximately their present positions. And it seems not improbable that it was as an adaptation to these drier conditions that the early Ferussaciidæ developed the specially large anal gland above the respiratory orifice, a feature which may have led in turn to the modification of the form of the kidney, and to some extent also of the shell, in the way I have already suggested. Moreover the underground habits of *Cecilioides* may have been induced by the same climatic cause : this genus may have originally burrowed into the soil in search for moisture, just as *Testacella* later burrowed in search for worms.

When the geographical changes occurred that accompanied the final separation of America from Europe and Africa, the climate of what is now the western part of the Mediterranean Region and the Atlantic Islands would probably become more insular in character and therefore less dry in summer. And if the anal gland has the function that I have suggested, it might then cause the mantle-edge of the Ferussaciidæ living in that area to become charged with moisture to an unnecessary extent, which would make it expand over the peristome of the shell (in forms that did not live underground), just as it does in *Ferussacia*, especially in the species still living in the insular climate of Madeira.

Possibly the paucity of vegetation in much of the area bordering the south-eastern shores of the Mediterranean Sea may have had something to do with the apparent acquisition of carnivorous tastes by *Calaxis*, a genus occurring in that region ; but until more is known about the comparative anatomy of this and the other remaining genera of the Ferussaciidæ, it would be useless to speculate further about their evolution.

CONCLUDING REMARKS.

Those who study mollusks seem often to ignore certain facts which I think are well illustrated by the subject of this Address, and to which I may refer briefly in conclusion.

In the first place we see that, in order to form a sound judgment on the affinities of a snail, one ought to examine carefully all the more important features of its anatomy, and not confine one's attention to one or two organs, as is so often done. Thus, in the case of *Ferussacia*, while the shell alone might suggest affinities with either *Oleacina* or *Cochlicopa*, we should probably have placed the genus in the Zonitidæ if we had only studied the mantle-edge and the foot, in

the Bulimulidæ if we had only examined the jaw, in the Achatinidæ if we had studied the radula alone, and in none of these families if we had restricted our attention to the male genital ducts or the kidney. To classify snails on the characters of, for example, the radula alone, or the genital ducts alone, is usually as unsatisfactory as it is to classify or describe recent forms on the characters of the shell alone, when the other organs are available for examination.

Secondly, I think what I have said illustrates the importance of considering the form of the various organs in relation to the functions that these organs subserve in the living animal, with special regard to its particular habits. We have seen, for example, that the peculiarities that characterise the anatomy of *Ceciloides acicula* only become readily intelligible when we take into consideration the animal's behaviour and environment. Whenever possible, therefore, morphological study should be correlated with observation in the field.

Lastly, I venture to think it is evident that the converse of this is also true. Valuable indeed are the many papers that have been written by members of this Society and others on the behaviour and distribution of mollusks ; but they would have been more valuable still if the authors had less seldom taken into consideration the anatomy or structure of the species with which they were dealing ; for, after all, the behaviour of anything, whether it is a mollusk or a molecule or a motor-car, largely depends on the way in which it is constructed. It is not difficult to look inside a snail ; the field awaiting investigation is immense ; and if what I have said should suggest that the subject is not without interest, this Address will not have been given in vain.



PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND.

559th Meeting, held at the Manchester Museum, November 2nd, 1927.

Mr. G. C. Spence in the chair.

Additions to Cabinet and Library.

A large series of shells from various localities ; also portraits of R. C. Rossiter and Capt. Thos. Rossiter, and some conchological pamphlets, presented by John Brazier.

Series of shells, mostly from Hungary ; *Pseudosuccinea* cf. *peregrina* from the Copenhagen Botanic Gardens ; and various photographs taken at the Budapest Conference, 1927, presented by H. Schlesch.

New Member Elected.

Cyril Ingram Paton.

Candidate Proposed for Membership.

T. W. Proger, F.Z.S., "Llanmaer," St. Fagans, Glamorgan (introduced by J. Davy Dean and G. C. Spence).

Member Deceased.

Percy E. Radley.

Papers Read.

"The Mollusca of the 'St. George' Expedition, I.," by J. R. le B. Tomlin, M.A.

"Note on bistomatism in *Delima gibbula* (Zgl.)," by Dr. W. T. Elliott.

"Mollusca eaten by Rabbits," by A. K. Lawson.

"Notes on a collection of land shells from Jamaica formed by the late George A. Martin," by J. Davy Dean.

Exhibits.

By Mr. J. D. Dean: Specimens to illustrate his paper.

By Mr. G. C. Spence: *Limicolaria kempi* Preston, from R. Kagera, Uganda; *Opeas cressyi* Conn., from district N. of Macequece, Portuguese E. Africa; *Brachypodella costulata* (Ad.), from Claremont, Jamaica.

By Mr. C. H. Moore: White varieties of British shells.

By Mr. A. K. Lawson: Specimens to illustrate his paper.

The Special Exhibit was Ferussaciidæ.

560th Meeting, held at the Manchester Museum, December 7th, 1927.

Mr. G. C. Spence in the chair.

Additions to Library.

"Manual of Conchology," pt. 109 (from Dr. H. A. Pilsbry).

"Zur Kenntnis der Molluskenfauna des Ostbaltikums mit Berücksichtigung der in Lettland vorkommenden Arten," by H. Schlessch (from the author).

"Lijst van gemeenten als vindplaatsen van Nederlandsche Mollusken," by W. S. S. van Benthem Jutting (from the authoress).

And other papers.

Donation to Cabinet.

Succinea oblonga, from Winchelsea, Sussex East (from J. R. le B. Tomlin).

New Member Elected.

T. W. Proger.

Candidate Proposed for Membership.

Frederick Archibald Sowter, 30, Nelson Street, London Road, Leicester (introduced by Thomas Edwards and J. W. Jackson).

Papers Read.

"The Nomenclature of certain British Mollusca, II," by J. Davy Dean.

"The development of the colour of *Arion ater*," by Dr. A. E. Boycott.

"*Vertigo alpestris* var. *albina* in Westmorland," by Dr. A. E. Boycott.

"A Note on *Hyalinia radiatula* found on several carnivorous plants," by Dr. G. H. Rodman.

"*Cypræa tigris* var. *nephelodes* nov.," by Lt.-Col. E. le C. Lancaster.

Exhibits.

By Mrs. Gill: Opercula of various species, showing variety of form and colour; also *Aporrhais pes-pelecani*, typical form and thick-lipped variety, from Abersoch, N. Wales.

By Mr. J. W. Jackson: A collection of the known species of *Aporrhais* including many locality sets of *A. pes-pelecani* from the British Isles. Among the latter were typical examples and thick-lipped forms (= var. *bilobata* Clément) from Southport; Maiden Lighthouse, off Larne, Co. Antrim; Lerwick, Shetland Is.; Loch Fyne, Argyleshire; and Teignmouth, Devon (R.D.D. coll.). Fossil examples of *Aporrhais* were also shown.

Accounts for the Year ended December 31st, 1927.

Income and Expenditure Account.

RECEIPTS.	£	s.	d.	EXPENDITURE.	£	s.	d.
To Balance from last Account	4	15	6	By publishing and distributing			
„ Annual Subscriptions				<i>Journal of Conchology</i> , Vol.			
for 1927 :				xviii, no. 3	30	11	11
133 at 10/-	66	10	0	„ no. 4	28	12	0
3 at 7/6	1	2	6	„ no. 5	24	13	1
1 at 6/-	0	6	0	(est'd) „ no. 6	30	0	0
32 at 5/-	8	0	0				
					113	17	0
	75	18	6	„ Authors' Reprints	13	18	8
Arrears ...	7	16	0				
					127	15	8
	83	14	6	Less provision made in			
„ Donations towards cost of				accounts for 1926	35	5	0
Illustrations ...	0	10	6				
„ Sale of Publications	17	11	3		92	10	8
„ Advertisements	2	2	6	„ Warehousing Stock	1	10	0
				„ Naturalists' Directory	0	10	0
				„ Fire Insurance	0	10	0
				„ Printing and Stationery	2	15	2
				„ Subscriptions :			
				Malacol. Society	1	1	0
				Zoological Rec.	0	5	0
				Lancs. & Chesh.			
				Fauna Com'tee	0	5	0
				„ Officers' Expenses	5	2	6
				„ Balance, being excess of			
				Income over Expenditure	4	4	11
	£108	14	3		£108	14	3

Life Membership Fund.

	£	s.	d.		£	s.	d.
To amount of Fund, Jan. 1st,				By Commission on purchase			
1927 ...	227	5	2	of Stock	0	2	6
„ Three Composition fees at				„ Amount of Fund, Dec.			
£6 6s. od. ...	18	18	0	31st, 1927	262	12	3
„ Donations by Life Members	5	0	0				
„ Dividends and Interest	11	11	7				
	£262	14	9		£262	14	9

BALANCE SHEET.

Liabilities.	£	s.	d.	Assets.	£	s.	d.
Annual Subscriptions paid in				4% Funding Loan, £308 13 10			
advance ...	5	0	0	cost	250	0	0
Est. cost of <i>J. of C.</i> , vol. xviii				Cash at Bankers	57	2	2
no. 6, and Authors' Rep'ts	35	5	0				
Life Membership Fund	262	12	3				
Balance of Income and Ex-							
penditure Account	4	4	11				
	£307	2	2		£307	2	2

NOTE.—Assets in addition to those set out in the Balance Sheet are (a) Library; (b) Cabinets and Collections; (c) Stock of unsold Publications; (d) Annual Subscriptions in arrear.

CHAS. OLDHAM,

Audited and found correct, 4th January, 1928.

Hon. Treasurer.

C. H. MOORE, }
F. TAYLOR } Auditors.

561st Meeting, held at the Manchester Museum, January 4th, 1928.

Mr. G. C. Spence in the chair.

Addition to the Library.

Autograph letter of W. H. Benson, from H. Schlesch.

New Member Elected.

F. A. Sowter.

Candidate proposed for Membership.

Svend Kierulf Petersen, Prins Valdemarsvej no. 1, Odense, Denmark (introduced by Hans Schlesch and Dr. W. T. Elliott).

Member Deceased.

Chas. Upton.

Resignation.

R. T. Millott.

Paper Read.

"The first known occurrence of *Limax tenellus* Müll. in Britain," by Chas. Oldham.

Exhibits.

By Mr. C. Oldham: Alder's original drawing of *Limax tenellus*.

By Mr. L. E. Adams: *Rossia macrosoma* (Chi.) from a consignment of sprats caught round the Isle of Wight.

By Mr. G. C. Spence: *Ceciloides actoniana* Ben. and var. *petitiana* Ben. from Gibraltar.

562nd Meeting, held at the Manchester Museum, February 1st, 1928.

Mr. G. C. Spence in the chair.

Additions to Library.

"The Snail as a Zoological Type" by A. E. Ellis, and "Marine Molluscs of the Island of Curaçao" by Tera van Benthem Jutting (from the authors); also papers from H. Schlesch.

New Member Elected.

Svend Kierulf Petersen.

Member Deceased.

Miller Christy.

Member Struck Off.

One member was struck off the List in accordance with Rule IV.

Paper Read.

"Fresh-water Pearls and Pearl-bearing Shells," by W. Harrison Hutton.

Exhibits.

By Mr. C. H. Moore: Series of *Pythia*, *Melampus*, and *Auricula*.

The Special Exhibit was *Lanistes*.

563rd Meeting, held at the Manchester Museum, March 7th, 1928.

Mr. G. C. Spence in the chair.

Additions to Library.

"Notes on British Post-Pliocene Unionidæ, II," by A. S. Kennard, A. E. Salisbury and B. B. Woodward.

"*Margaritifera margaritifera*: Notes on the Variation of the British and Irish Forms," by H. H. Bloomer.

"Kleine Mitteilungen, II," by H. Schlesch.

"The Functions of a Local Natural History Society," by Robert Gurney and others (from the respective authors).

Paper Read.

"Note on the Fauna of The Hanging Wood above Creech Grange, Dorset,"
by E. St. John Burton.

Exhibits.

By Mr. C. H. Moore: Foreign *Littorina*.
The Special Exhibit was *Odontostomus*.

CYPRÆA TIGRIS Linné, var. NEPHELODES,¹ nov.

By Lt.-Col. E. LE C. LANCASTER, R.A.M.C.

(Read before the Society, December 7th, 1927).

SOME months ago I received from Mr. H. C. Fulton a remarkable specimen of *Cypræa tigris* Linné, which appears to merit description and varietal designation.

It is not described in Hidalgo's classical monograph on *Cypræa*, although he enumerates and distinguishes 17 varieties apart from the type.

Testa dorso spisse cinereo-cærulescente; medio maculis ferrugineis inæqualibus, raris, subter vix dispectis, lateribus et extremitatibus gradatim colore minus, maculis magis, conspicuis; linea dorsali media, lata, præcipue ad extremitates, margine dextro pallido luteo, sinistro fusco; basi et dentibus ad speciei normam; macula fusca labii pæne medio, valde conspicua.

Longa 102 mm. ; lata 66 mm.

Habitat, Queensland.

Shell with the dorsum thickly clouded over with an ashy-blue wash, through which the irregular sparsely scattered rusty-brown spots are but obscurely visible. This ashy-blue deposit fades gradually towards the extremities and the sides, the spots hence becoming more conspicuous. Dorsal line central, broad especially towards the extremities, pale whitish yellow margined with brown on the left side. Base and dentition as in type; the characteristic brownish splotch towards the centre of the inner lip being well-marked.

¹ νεφέλωδης, = cloudy.

THE DEVELOPMENT OF THE COLOUR OF ARION ATER.

By A. E. BOYCOTT.

(Read before the Society, December 7th, 1927).

INFANT *A. ater* are ordinarily whitish or cream-coloured with darker tentacles; sometimes greenish-yellow. The "normal" colour first appears as a diffuse duskiness on the back, grows darker and spreads down over the sides to the fringe and later on to the foot where the two lateral areas darken first; the central area of the sole is the last to lose its white colour. The time-relations of this process vary a great deal and its full accomplishment is often not finished during the lifetime of the slug. Hence we have a series of full-grown forms which represent the various stages of development. The cream-coloured var. *alba* (not a complete albino) is infantile. Round Aldenham (Herts.) the commonest adult is cream with a varying small amount of dusky grey on the back: var. *albolateralis*¹ is an adult with a degree of pigmentation usually seen in specimens about one-third grown. Black adults with white soles are sometimes found, and in the "typical" var. *ater* the sole is grey, the centre paler than the sides; this is generally the most intense stage which is reached. But in the var. *aterrima*, which is characteristic of moorland, the body generally is distinctly blacker and the whole sole is black too. The pigmentation in short develops slowly in var. *alba* and quickly in var. *aterrima*. I do not know what is the colour of the infant *aterrima*; the smallest I have seen, about $1\frac{1}{2}$ in. long, already had grey soles. The stage in growth at which pigment appears is known in some instances to be a heritable character, so it must not be assumed that the different colour-forms of *ater* are purely environmental in origin (*cf.* E. B. Ford and J. S. Huxley: *Brit. J. Exp. Biol.*, 1927, v. 112).

¹ Not confined to the north and west: specimens from Herts. are just like those from West-morland and Carnarvon.

EXPLANATION OF PLATE IV.

Ferussacia oranensis Bgt.

Gambetta, Oran, Algeria.

Fig.

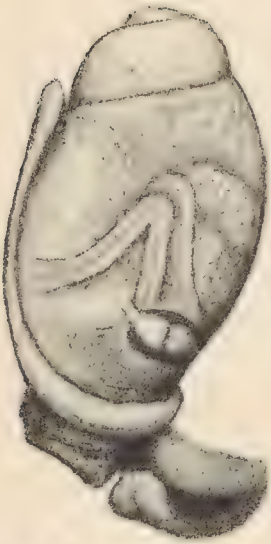
1. Animal in shell, showing foot, genital opening, etc. (The tentacles are not quite fully extended). $\times 7$.
2. Empty shell, normal form. $\times 5\cdot25$.
3. Empty shell, form with parietal fold. $\times 5\cdot25$.
4. Embryo from uterus, showing pallial organs, etc. $\times 18$.
5. Genital organs and free retractor muscles. $\times 17\cdot5$.
6. Longitudinal section of posterior half of penis. $\times 35$.
7. Central nervous system, viewed from above. $\times 16$.
8. Mantle-edge, viewed from the front. $\times 7$.
9. External aspect of pallial organs and anterior part of liver, viewed as if flattened out, and showing the anal gland and mantle-edge on the left, the loops of the intestine on the right, and the kidney and ureter, with the heart and pulmonary vein below them, towards the centre. $\times 10\cdot5$.



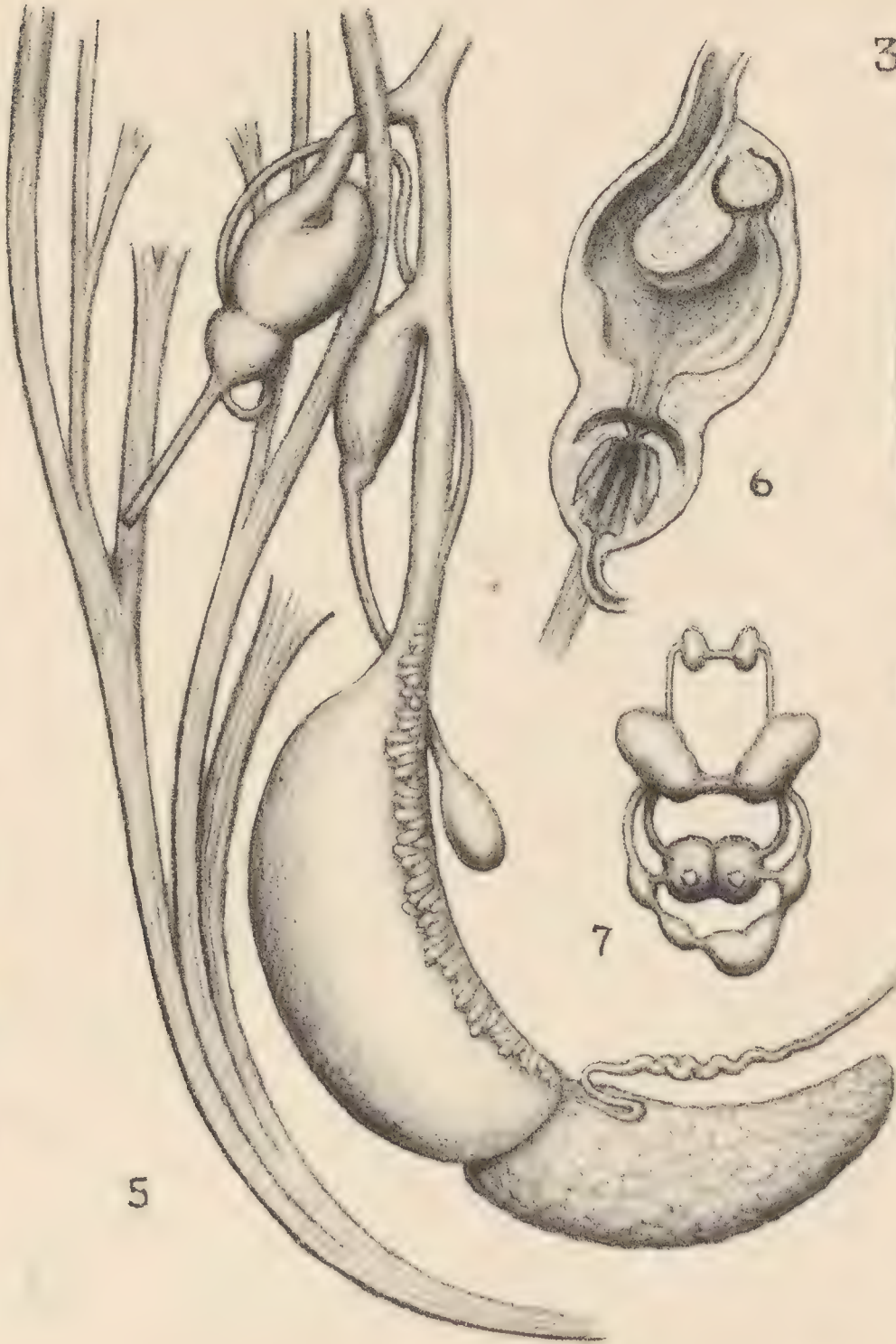
1



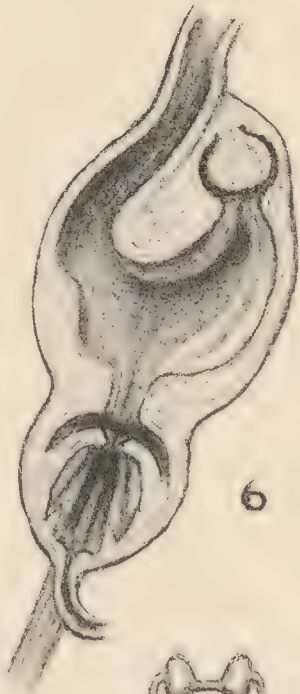
2



4



5



6



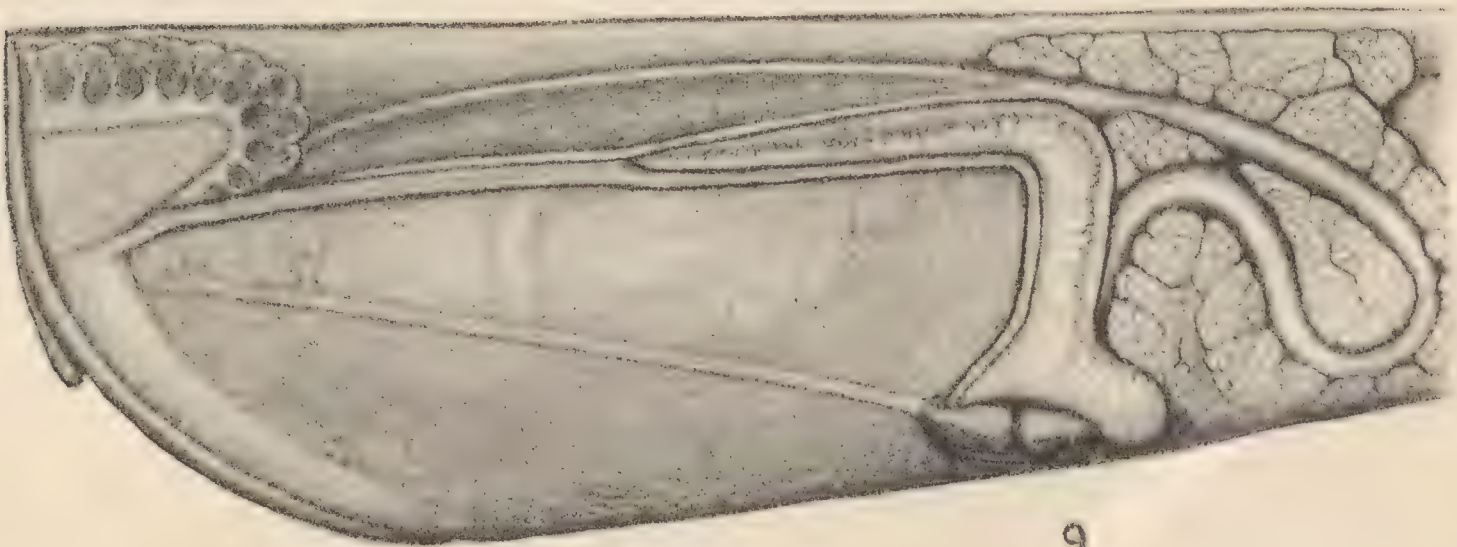
3



7



8



9

FERUSSACIA ORANENSIS Bgt.

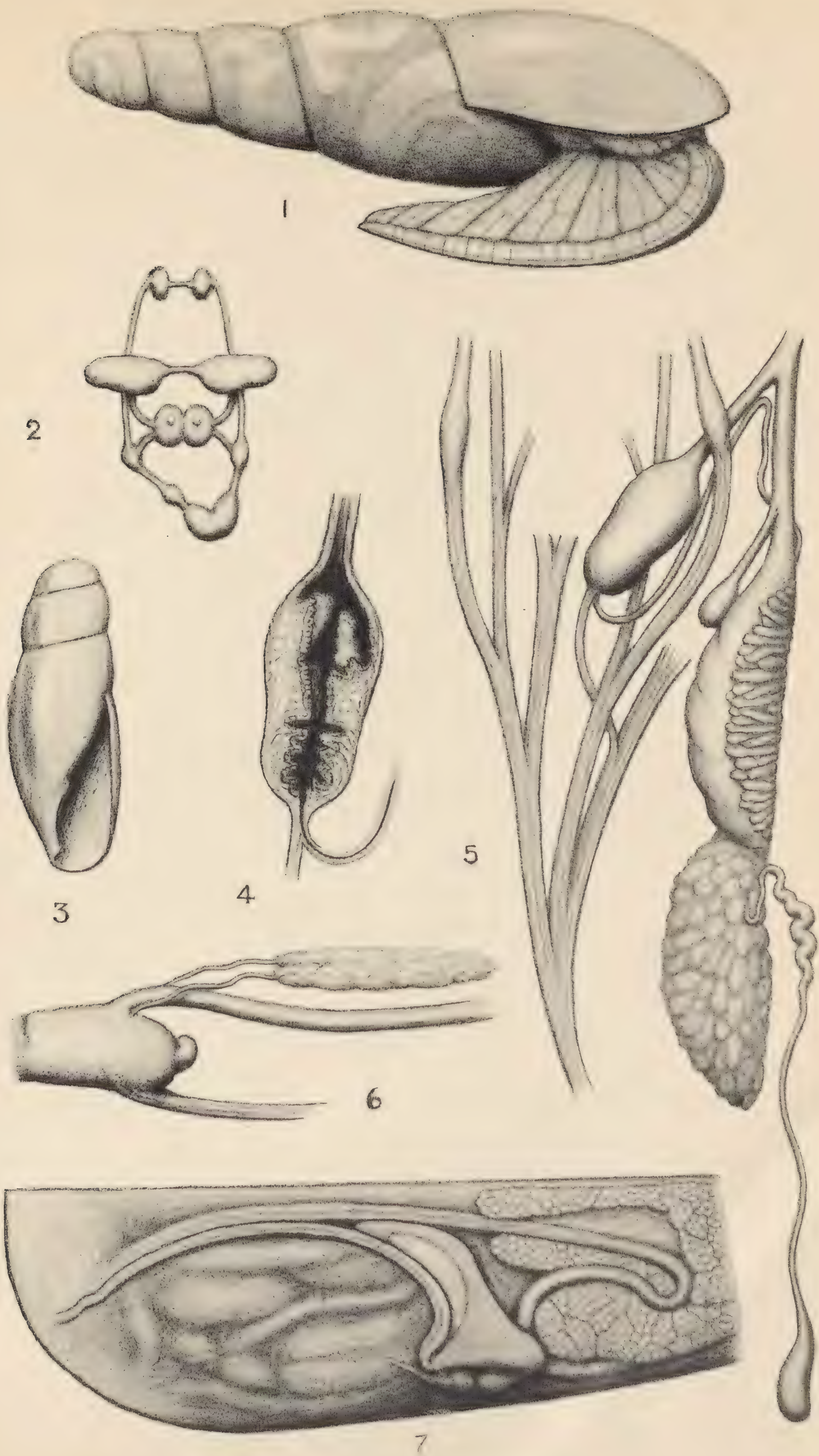
EXPLANATION OF PLATE V.

Ceciloides acicula (Müll.).

Cadbury Camp, Tickenham, North Somerset
(except fig. 3 which is drawn from a specimen collected at
Hauxton, Cambridgeshire).

Fig.

1. Animal in shell, showing foot, etc. $\times 20$.
2. Central nervous system, viewed from above, $\times 30$.
3. Young shell, showing columellar fold. $\times 20$.
4. Longitudinal section of posterior half of penis. $\times 50$.
5. Genital organs and free retractor muscles. (The spermatheca is shown slightly displaced to the left, as otherwise it would have been hidden by the spermoviduct). $\times 30$.
6. Buccal mass, œsophagus, and salivary glands, viewed from the side. $\times 25$.
7. External aspect of pallial organs and anterior part of liver, viewed as if flattened out, and showing the mantle-edge and the anal gland (with the rectum and ureter curving down beneath it) on the left, the loops of the intestine on the right, and the kidney. with the heart below it, towards the centre. (The organs showing faintly through the mantle-cavity are—the spermoviduct at the top next to the ureter, the penis immediately beneath it towards the left, the œsophagus passing below the right ends of both the penis and the spermoviduct, the two cerebral ganglia united across the left end of the œsophagus, the salivary glands showing below the rest of the œsophagus, the right tentacular retractor passing down on the extreme left, and the left tentacular retractor passing along the base in the figure). $\times 25$.



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THE
JOURNAL OF CONCHOLOGY.

VOL. 18.

DECEMBER, 1928.

No. 9.

NOTES ON BRITISH MOLLUSCA.

By ALAN GARDINER, B. Sc.

(Read before the Society, May 12th, 1928).

Oncidiella celtica (Cuvier). I had some opportunity of observing the habits of this animal during September and October at Trevone, North Cornwall. It occurs over a very limited area, in fact only two or three were found except on one ledge of rock which runs at right angles to the line of the coast and faces north. The rocks are so situated that the habitat must be generally protected from the full force of the waves, which is very great at this place. I was surprised to find it in such a low zone; local people told me that the rocks in question, which have a curtain of *Fucus serratus* and are covered with *Corallina officinalis* and other calcareous algæ of the genus *Melobesia*, chiefly, I think, *M. lichenoides*, are only really uncovered to any extent at low water of spring tides. This seems curious for an alleged pulmonate, for the animals would seem to be able to breathe air only at long intervals, and then by taking quite a long journey to the highest points of the rocks.

This, it seems possible, they may be able to do, for the first batch collected was placed in a vessel of water standing on a chest of drawers. A few hours later it was found that they had not only crawled out of the water and fallen or crawled to the floor, but had walked over the carpet and boards for a distance of seven feet in some cases. At other times they rested quite peacefully in their aquarium, and it struck me that their periods of unrest coincided with the tidal rhythmic movement, and they showed a desire to travel when the tide was low. This would not be surprising when it is known that *Littorinæ* show this phenomenon even when many miles from the sea (*vide* "Biology of the Sea-shore," p. 239, Hattely and Walton).

The curious point about this animal would seem to be that it inhabits a much lower zone in some places than others, some of these being surprisingly low for a pulmonate. Its occurrence in so few spots of a given area, all of which seems equally suitable for it, is also remarkable.

Cerithiopsis tubercularis (Montagu). While collecting in the *Zostera* at Helford, it was noted that it was almost impossible to find a specimen of a particular sponge, which is very common at this place, which did not contain at least one of these molluscs.

Some animals were found with a thin coat of the sponge, while in other cases the mollusc was found in the centre of a sponge which measured as much as two inches in diameter.

Calliostoma zizyphinus (Linné) v. **lyonsi** Leach. This form seems to be very local. Miss K. M. White captured two specimens of it near the mouth of the Helford River, Cornwall. The only other examples which I have seen alive were found by myself within a mile of the same place.

Kellia suborbicularis (Montagu). A colony of this species was found under a large rock situated at low water, spring tide mark. It also occurred in old oyster shells.

Littorina littorea (Linné). Hundreds of specimens of this shell were seen at Helford covered with colonies of *Hydractinia echinata*. We failed to find this Hydrozoon on any other shell at this place.

Aplysia punctata (Cuvier). Amongst hundreds of this, feeding on *Enteromorpha* at the mouth of the river near Padstow, one very large almost white individual was captured.

Philine aperta (Linné). A very large example of this species was found under a stone in a rock pool at Gillan Creek near the mouth of the Helford River. It was $2\frac{1}{2}$ inches in circumference and over $1\frac{1}{4}$ inches in length. I was doubtful about the identification of this animal owing to its great size and unusual habitat, until it was inspected by Mr. R. Winckworth.

Archidoris britannica Johnston. Was found both under stones in pools and in the *Zostera* at Helford River.

Sepia officinalis (Linné). A large mass of ova, threaded on *Zostera*, was found in the Helford River.

Montacuta bidentata (Montagu). Very numerous examples of this were found in the burrows of *Phascolosoma* both at Helford and Salcombe.

Spirula spirula (Linné). One specimen was found on a beach near Portscatho, Cornwall: in large numbers at Croyde, N. Devon last August.

Large Bithynia tentaculata.—In June last at a joint meeting of the Yorkshire Naturalists' Society and the Yorkshire Conchological Society I was fortunate in finding a specimen of *Bithynia tentaculata* 17 mm. in length in the River Foss, at York. This seems to me a remarkably large example and I shall be glad to hear of other finds. Mr. H. Sowden, the President of the Yorkshire Society, has specimens almost as large.—(MRS.) ELSIE M. MOREHOUSE (*Read before the Society*, 1st September, 1928.)

ON THE IDENTITY OF CLAUSILIA CRAVENENSIS Taylor
WITH CLAUSILIA SUTTONI Westerlund.

By J. DAVY DEAN, F.E.S.

of the Department of Zoology, National Museum of Wales.

(Read before the Society, May 12th, 1928).

PLATE VI.

WESTERLUND'S original description appeared in 1881 in the "Öfversigt af K. Vetenskaps Akademiens Förhandlingar" Vol. 38, No. 4, p. 58—Stockholm.

"*Clausilia (Iphigenia) dubia* Drap. var. *suttoni* mh. Testa fusiformis, subventricosula, spira breve attenuata, castanea vel ceracina, nitens, sub lente tenuissime clathrata, ad aperturam striata; anfr. 11, convexiusculi, sutura marginata sat impressa disjuncti, ultimus basi sat alte carinatus; apertura ad sinistrum vergens, ovata, basi canaliculata, sinulo magno, rotundato, peristomate expanso, albo; lamella infera perobliqua, antice crassa, alba, saepe bigibba, intus ramis tenuibus duobus obscuris mox ascendentibus et desuper intuenti inconspicuis; plicae palatales superae 2, principalis vix ultra lunellam producta, altera minima cum lunella conjuncta, infera obsoleta, in callo tenui peristomati parallelo transiens, subcolumellaris profunde demersa, sed immersa.

Long. 13–14, diam. 3 mm.

Britannia.

Från Dr. W. D. Sutton in Newcastle har jag erhållit några exemplar af en *Clausilia*, som han i fjor fann på ett par ställen Northumberland och Durham och hvilken af Dr. J. Gw. Jeffreys blifvit bestämd till *Cl. dubia* Dr. var. *Schlechtii* Zel. efter A. Schmidt's "Die kritischen Gruppen der europ. Claus." Visserligen är det åtskilligt, t.ex. färg och skulptur, hos den engelska snäckan, som hänvisar på den af Zelebor i de österrikiska alperna funna och af Schmidt beskrifna, men den för den sednare viktigaste karakteren 'das ausserordentlich schlanke Gehäuse mit dem eben so stark wie als bei *Cl. tettelbachiana* entwickelten Kiele,' saknas alldeles hos den förra, som har samma, nästan bukigt spollika, skalform, som artens typ, Draparnaud's *dubia*, men en bredd af fulla 3 mm., mot 13–14 mm. längd (icke, som v. schl., $2\frac{1}{4}$ – $2\frac{1}{2}$ mm. tjocklek och 12 mm. längd)."

Dr. Sutton's paper on "A variety of land shell new to Britain" (*Clausilia rugosa* var. *schlechtii*, Zelebor) in the *Journal of Conchology* Vol. 1, p. 35 refers to the same shell. The determination here is by Jeffreys. Dr. Sutton says "The new variety referred to is

apparently confined to one or two spots in the counties of Northumberland and Durham, the best specimens being found in the latter county, in a particular locality not far from the coast." This locality is Marsden, according to the label on the type specimen, here figured from photographs kindly sent by Prof. L. A. Jägerskiöld, Director of the Göteborg Museum, where the Westerlund collection is housed. Dr. Sutton adds "They are generally larger, more elongated, smoother and more transparent than *Cl. rugosa* var. *dubia*, the colour is likewise different; whereas the latter attains occasionally a fine purple colour, and runs generally through the usual shades of brown to purplish brown, the former appears only in a pale brown form, frequently resembling in external appearance '*Clausilia laminata*,' both in smoothness and transparency."

I quote this last sentence fully because it has been so much copied, for example by Rimmer¹, until colour, smoothness and transparency have assumed an importance out of all proportion, and surely beyond all intention. In 1892 J. W. Taylor, Roebuck and Nelson, acting as Committee for the publication of the Society's List, retain *dubia* Drap. (for the Craven shell) and *suttoni* Westerlund as varieties of *Clausilia perversa* (Pult.) = *rugosa* Drap. and say they are unable to concur with Boettger, Westerlund and others in uniting the two. In 1894 Taylor renamed the Craven shell *cravenensis*² though as a varietal name he perhaps did not consider it necessary to give a formal description.³ He states that *suttoni* shows no striation under an ordinary lens. It will be noted, however, that the photograph of Westerlund's type specimen distinctly shows traces of the striation, though the shell appears as if worn smooth. Similar shells can be collected in the heart of the Craven district and my own experience is that, when taken on Ash bark of growing trees, the shells are frequently so rubbed that not a trace of striation remains.

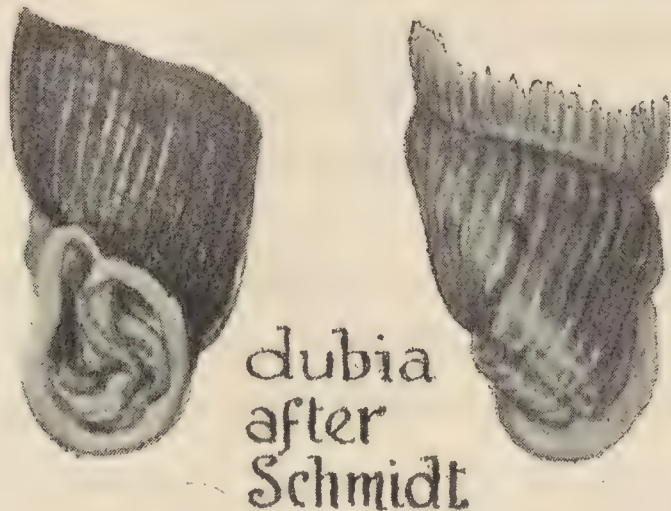
I have never had any doubt as to the specific distinction of the shell we have so long, and without question, called *Clausilia cravenensis* Taylor. I should separate *dubia* entirely. In typical *dubia* there are nine whorls; the shell is flecked with characteristic white streaks; it is very highly polished, as is *bidentata* Ström (= *rugosa* Drap.); and the suture is deeper than in *cravenensis* Taylor. The greatest width is nearly at, but a little below, the centre of the shell, and the longitudinal striation is extremely inconstant. The mouth is smaller and not white-lipped and while the difference in armature is most elusive and variable, there is greater contraction at the mouth which, typically, affects the shape of the clausium; this is narrower

¹ "Land and Freshwater Shells of the British Isles," Richard Rimmer, 1880, p. 173.

² Collector's Manual of British Land and Freshwater Shells, L. E. Adams, 1884, 1st. Ed., p. 89, and 1896, 2nd Edition, p. 106.

³ "J. of Conch." Vol. vii, p. 422.

and more bent in *dubia*.¹ In *cravenensis* Taylor² and *suttoni* Westerlund there are typically ten whorls; the shell is polished but not highly polished. It is practically $3\frac{1}{2}$ millimetres in width and *the full width is not reached until the commencement of the last whorl*. Outlines



from Schmidt's drawings in "Die Kritischen Gruppen der Europäischen Clausilien" placed side by side with carefully measured examples of *cravenensis* Taylor will emphasise this difference. (Plate VI). The form which would seem to approach more nearly in length to *cravenensis* is var. *speciosa* Sch. = *gobanzi* Parr. ap. Pfr.³ but this is merely an extreme form with an extra whorl and still retains the characters of *dubia*. While one feels certain of such differences it is an extremely difficult matter to prove them, though a drawing or photograph will sometimes do more than a description. The drawings of *cravenensis*, the long and the short form, were made before any comparison of the photograph of Westerlund's type was possible. The latter was then enlarged to the same scale. The relationship of the two extremes with the type of *suttoni* was seen to be very close, with this exception, that the type is a smooth shell. In form of shell and width there is no doubt that the two are identical. Mr. Hans Schlesch, to whom I am indebted for help, considers Taylor's description of the lamella of

¹ J. of Conch. XVI p. 161 (text figure).

² Taylor says 13, op. cit.

³ Monographia Clausiliarum, Westerlund, p. 130.

cravenensis to agree entirely with the description of the lamella of *suttoni* by Westerlund. He is also with me in considering the British shell as quite distinct from the *dubia* Drap. of the Continent. It is very likely that the polymorphic character of *dubia* Drap. decided Westerlund to describe Dr. Sutton's specimens as a form of that species. My own conclusion is that Boettger and Westerlund were right in regarding the rugose form of the Craven Highlands as specifically identical with the thinner and more transparent shell from Durham and Northumberland.

Actual comparison of Westerlund's type specimen of *suttoni* with typical *cravenensis* from Settle, Yorkshire, has been most kindly undertaken for me by Dr. Odhner who writes as follows:—

"Westerlund's specimen is shorter and somewhat more swollen than yours; it has ten whorls. Its aperture is somewhat narrower across the median height, and thus somewhat more regularly squarish. The lamellation of aperture is the same, except that the callosities are a trifle stronger, but otherwise the pad inside the outer wall, the basal furrow and the basal callus are quite as in your specimen. There are no traces of interlamellar folds (or false folds) such as are seen in your specimen (being only some longitudinal riblets of the external sculpture which appear inside the aperture), a fact clearly explainable from the thicker layer of enamel covering this palatal wall and perhaps also from a slightly weaker external sculpture. This is, however, evidently worn off, exhibiting only faint traces of longitudinal riblets quite as close as in your specimen, and more indistinct traces of spiral liræ which seem to have been of the same strength as those of your specimen.

From the above statements I draw the conclusion that, as far as sculpture and aperture are decisive, the two specimens are specifically identical, unless the shape of the shells be of distinctive importance."

I have to express my great thanks to Lt.-Col. A. J. Peile for his care in examining the radula of *cravenensis* from Grassington, Yorkshire,¹ and comparing this with typical *dubia* from Arzier, Jura, alt. 1000 ft.² He says "I should not consider the radulæ or jaws sufficiently alike to unite the species." His analysis is—

<i>dubia.</i>	No. 1.	21.	1.	20	} x 83 + nascent.
	=	12.9	1.	8.12	
	No. 2.	22.	1.	21	} x 79 + nascent.
	=	12.10	1.	9.12	

Some lines of marginals show irregular succession as regards subsidiary cusps.

¹ From J. W. Taylor, Leeds.

² Collected by Dr. Mermot, Geneva.

suttoni (= *cravenensis*)

No. 1.	19.	I.	19	} x 93 + nascent
	= 10.9	I.	8.11	
No. 2.	20.	I.	20	} x 80 + nascent
	= 10.10	I.	9.11	
No. 3.	19.	I.	19	} x 80 + nascent
	= 11.8	I.	8.11	

Succession of cusps in some lines of marginals queer, as in *dubia*.

He points out that in the marginals of *dubia* the bases are less square than in *suttoni*, and that the jaw of *dubia* in each example is more solid than that of *suttoni*.

The distribution of *Clausilia suttoni* Westerlund would appear to have been more general in the past. There are the Oxford records and there are specimens from Stow Wood, Oxford, in the National Museum of Wales collections (Dr. Y. H. Mills coll. 16.174), besides the records by Collinge for Banbury and Wychwood. Bean collected it at Scarborough and there is a specimen in the Hull Museum (Schlesch coll.) which I have seen. It may never be possible to confirm some records owing to deforestation of original woodland. At Addingham, near Leeds, the effect of adverse conditions has led to the species becoming permanently dwarfed. The same may be possibly the case at Marsden, Durham, the type locality.

Clausilia dubia Draparnaud was first recorded for Dover in 1882 by the Rev. Dr. A. H. Cooke (McAndrew coll., *J. of Conch.* III p. 389). I have seen three specimens (coll. H. Overton) which I believe to be *dubia* Drap.

My best thanks are due to Mr. Schlesch of Copenhagen, for a copy of Westerlund's original description of *suttoni*; to Prof. Jägerskiöld, Director of the Göteborg Museum, who most kindly sent me photographs of Westerlund's type shell; to Dr. Nils Odhner of the Riksmuseum, Stockholm; to Mr. Tomlin for the loan of specimens and for much helpful advice, and to others who, by their kindness, have enabled me to examine specimens from various continental sources.

The illustrations to these notes do not perhaps need any further explanation. One of the three Dover examples of *dubia* mentioned above is figured at the base of Plate VI, to show the armature and with it are three of the continental varieties of *dubia*, including *schlechtli*, a small, attenuate race.



ON PIROSTOMA DUBIA CRAVENENSIS Tayl., ITS
AFFINITIES AND ITS GEOGRAPHICAL ORIGIN.

BY DR. W. POLINSKI (WARSAW).

PLATE VII.

(Read before the Society, May 12th, 1928).

INTRODUCTION.

IN vol. VII of the "*Journal of Conchology*," 1894, p. 422, J. W. Taylor has described a new British form of Door Snail under the name *Clausilia bidentata* var. *cravenensis*. Several conchologists, as we know, have recognised this form to be a distinct species, *Clausilia cravenensis*, and referred to it not only specimens from the North of England but also those from Dover, as is the case for instance in the well-known "Census" of W. D. Roebuck (*J. of Conch.*, XVI, 1921). Others, on the contrary, consider *cravenensis* Taylor identical with *dubia* Drap., and Kennard and Woodward omit completely the first one of these forms in their "Synonymy of the British Non-marine Mollusca," 1926.

Last year Mr. J. R. le B. Tomlin kindly asked me to express my opinion on *Clausilia cravenensis* and sent me several shells, while Mr. J. W. Taylor obliged me by sending some living specimens for anatomical study.

THE GENITAL SYSTEM OF PIROSTOMA DUBIA, CRAVENENSIS AND
BIDENTATA.

During my studies I compared directly the genital system of the above mentioned specimens of *Pirostoma cravenensis* from Craven Highlands, shells of 12-13 1/4 whorls, length 14.3-16.3 mm., with that of *Pir. dubia* Drap. and of *Pir. bidentata* Ström. The dissected specimens of the former, 10-12 whorls, length 11-14 mm., originate from four localities of the Polish Jura between Kraków and Częstochowa and from Zutphen in Holland (f. *obsoleta*), wherefrom they have been most kindly forwarded to me by Miss Tera van Benthem-Jutting; the specimens of *Pir. bidentata*, 10-11 1/4 whorls, length 10-12.1 mm., have been collected at Rozewie on the Polish coast of the Baltic Sea.

I am giving below, in tabular form, the results of my measurements of the genital system of the above three forms, including also the figures obtained for Danish *dubia* and *bidentata* by C. M. Steenberg (in "Mindeskrift for Jap. Steenstrup," København, 1914.)

	<i>Cravenensis</i>		<i>Dubia</i>		<i>Bidentata</i>	
	England	Holland	Poland	Denmark	Poland	Denmark
	mm.	mm.	mm.	mm.	mm.	mm.
Glandula hermaphroditica	3.7-4	3.2-3.4	3.2-3.6	3.2-3.6	2.5-3.1	3.25-3.7
Ductus hermaphroditicus	2.8-3.5	3 -3.1	2.8-3.4	3.35	2.7-3	2.35
Vesicula ovo-seminalis ...	0.5	0.4	0.5	0.46	0.4-0.5	0.55
Glandula albuminalis ...	1.5-2.6	1.5-1.7	1.4-1.9	1.7-2.3	0.7-1.2	1.7
Spermoviductus ...	6.6-6.9	4.3-5	4.2-5.8	4.93	5.3-5.6	4.2
Pars infraprostatica ovi- ductus ...	2.1-2.4	1.9-2.1	1.9-2.3	1.86	1.3-1.7	1.1
Receptaculum seminis ...	1.8-2.1	0.6-1.4	0.9-1.3	} 5.12	1 -1.5	} 3.5
Ductus receptaculi ...	4.2-4.6	3.9-4.5	3.5-4.8		3 -4.7	
Diverticulum receptaculi	4.1-5.9	3 -3.4	3 -4.1	3.63	2.2-2.8	1.58
Vagina ...	2.9-3	1.7-2	1.8-2.3	1.12	1.6-2.3	1.7
Penis+epiphallus...	0.7-0.9	0.7	0.6-0.7	0.74	1.2-1.3	1.2
Vas deferens ..	6.4-7.2	4.9-5.2	5.2-7	5.67	3.9-4.1	2.5
Musc. retractor penis ...	4.5-5.5	4	4-5	2.8	4-5	5.4

(contracted)

The hermaphrodite gland consists of acini with a blackish pigmentation at their tops, aggregated in several bundles which are arranged in a spiral row. In Polish specimens of *bidentata* I could state most frequently 7 bundles consisting of slender acini; in the Danish ones there are found according to Steenberg (loc. cit., p. 35, fig. 21) 6-9; Polish and Danish specimens of *Pirostoma dubia* show 6-7; the Dutch ones 5-8 bundles of glandular acini; in *cravenensis* I have found 4-7 bundles and in one specimen which has been examined in detail in this respect the number of the acini was as follows; bundle I 18, II 14, III 21, IV 22, V 16, VI 11, VII 8.

The hermaphrodite duct, the vesicula ovo-seminalis, the spermoviduct, the triangular albumen gland, and the penial retractor muscle do not show any distinct differences. On the other hand the shape and the size of the male copulatory organ is of great taxonomic importance.

The penis + epiphallus of *Pir. bidentata* is thick and comparatively long, in the Polish (fig. 10) and West Pomeranian specimens (vide Lehmann "Die Leb. Schn. u. Musch. Stettins," 1873, fig. 58) swollen fusiform in shape; in those from Denmark it is enlarged chiefly on the outer side; at the transition into the vas deferens it forms a very peculiar narrow sharply bent loop.

In *dubia* (fig. 6) and in *cravenensis* (fig. 7) the penis + epiphallus is much smaller, the curvature of the loop much softer and the loop itself much thicker.

The vas deferens may be divided into three portions, according to its thickness. The proximal one is in *bidentata* fairly long and slender, the middle one long and at the same time thick (in the Danish specimens of *bidentata* this portion is situated somewhat nearer to the prostate); finally there is a thin apical portion not

widened at the transition into the epiphallus. In *dubia* and in *cravenensis* the thickest portion occupies a larger part of the vas deferens than in *bidentata*, and the apical portion is also comparatively rather thick.

The vagina is in the Danish specimens of *bidentata* strongly widened in its lower part. In the Polish specimens, as well as in those from West Pomerania the vagina is, as we can judge from the indistinct figure of Lehmann, widest in its upper middle part.

In *cravenensis* and in *dubia* the upper portion of the vagina is the widest of all. The free oviduct is not only absolutely but also relatively somewhat longer in *dubia* and in *cravenensis* than in *bidentata*, the same being the case with the length of the transparent and delicate diverticulum receptaculi and ductus receptaculi (spermatheca duct). The spermatheca shows a rather variable shape and size, as is shown in the figures; in *bidentata* it is more distinctly separated from its comparatively thin duct; in *cravenensis* usually widened near the base.

As we see, the morphological differences of the genital system of *cravenensis* and *dubia* on the one side and of *bidentata* on the other are so considerable, that they allow a strict distinction to be made between the two former and the third one.

As to the systematic relation between *cravenensis* and *dubia*, the same relative size and the same characteristic shape of the male copulatory organ are of decisive importance; these characters prove, without any doubt, the conspecific relation of the form *cravenensis* with *Pirotoma dubia*. But on the other hand the greater length of the spermatheca and of the diverticulum receptaculi in *cravenensis* as well as the absence of pigment on the vesicula oviseminalis, which constitute less constant and less important differences, correspond to well marked conchological differences shown further, and possess the value of subspecific distinguishing characters. Hence the name of the Door Snail which is discussed in the present paper should be *Pirotoma dubia cravenensis* Taylor.

CONCHOLOGICAL, TAXONOMIC AND ZOOGEOGRAPHICAL ANALYSIS.

The smaller specimens of subsp. *cravenensis* differ but little in shape from the most common forms of continental *Pirotoma dubia*; the larger ones are more slender and more tapering towards the apex. The colour is dark, often blackish-cerise, in fresh specimens slightly shining. The striation of the surface very delicate but more dense than in ordinary quasi-typical specimens from the North-Eastern Alps, from the West Carpathians and from the Polish Jura. This striation recalls most the striation of specimens from S.E. France

and of those from the region of the middle Rhine. Subspecies *cravenensis* approaches also the specimens just mentioned in the very peculiar finely flexuous course of the striae, especially marked on the lower whorls, as also in the usually very well expressed and numerous spiral striae, which impart to the surface of the shell a decussated appearance; this character is found also in specimens from the middle and N.W. parts of the continent, although more seldom and not so distinctly expressed.

The shells of specimens from Penrith which I was able to examine show $11\frac{1}{2}$ -12 whorls, measuring 12.7—13.7 mm. in length; those from Yorkshire (Craven Highlands, Ingleton, Middlesbrough) which I have received from Messrs. Tomlin and Taylor have $11\frac{1}{2}$ -13 whorls and are from 13.2 up to 16.6 mm. in length. A. E. Ellis gives in his "British Snails" for *dubia* length 16 mm., diameter 3.5 mm.: J. W. Taylor indicates in his original diagnosis 13 whorls, 14-17 mm. of length and a diam. of 3.5 mm. These dimensions exceed those of specimens from the North-Central and Western parts of the European continent.

Among all the forms of this polymorphic door-snail similar dimensions are reached only by two other subspecies of *dubia*; of these the subspecies *podolica* Bakowski (in Sprawozd. Kom. Fizj. Akad. Um. Kraków, 1880), which inhabits the rocky Podolian canyon of the Dniestr in S.E. Poland measures 14-18 mm. in length; the other subspecies, viz. *speciosa* A.Schm., from the Styrian limits of the Eastern Alps, is sometimes still larger: specimens from the limestone rocks of Peggau on the river Mur, which I have measured, show $14\frac{1}{2}$ whorls and reach 18.2 mm. in length, while Tschapeck (in Nachrichtsbl. D. Mal. Ges., 1885) gives for the f. *gobanzi* Pfr. of this subspecies as much as 20.5 mm. It is curious that this largest form is found only at a distance of 12 kilometers away from a not less well differentiated tiny local *Pirostoma dubia* subsp. *runensis* Tschap.; specimens in the collection of the Polish Museum of Zoology have only $8\frac{1}{2}$ -10 $\frac{1}{2}$ whorls and a length of 6.9-9.2 mm.

It is very significant that the above mentioned three subspecies as well as other forms of *Pirostoma dubia* from the eastern limits of the Alps, from the S.E. Carpathians (subsp. *transilvanica* A.Schm.) and from the Dniestr-Basin, which live in territories bordering on the plains of Hungary, Transylvania, Wallachia and Podolia, where the climate is rather a continental one, possess the armature of the aperture of the shell most strongly pronounced; this armature represents a morphological adaptation, which helps efficiently to regulate the transpiration. The inferior lamella is in the aperture "step-like," broken or bifurcate at the end, and its margin is in the interior of

the last whorl strongly inclined towards the upper lamella, the free space between the lamellæ being thus more narrowed; the spiral lamella is high; a thick palatal swelling is present; the lower palatal plica is particularly strong and long in the subsp. *speciosa*; the plate of the clausilium is deeply grooved inferiorly with a strongly angular outer terminal lobe.

On the contrary, the British subsp. *cravenensis*, which lives on rocky highlands in a more uniform oceanic climate under the direct and constant influence of damp sea winds, shows in a high degree the characters of obsoletism. The inferior lamella rather low, distinctly diverging exteriorly from the superior one, grows not very thick towards the end, showing little tendency to form "steps" there or scarcely visible prolongations on the peristome. In the posterior half of the wide inter-lamellar area the inferior lamella emits a usually distinct thickened line, which gives to the inferior lamella a backwards-bifurcate appearance; this bifurcation forms a somewhat more acute angle than in the British *Pir. bidentata*. The inferior lamella deeply seated, very oblique and usually little visible in the aperture, especially in the form *suttoni* Wstld. The spiral lamella is low also in its posterior portion, being especially low about its junction with the superior lamella. The subcolumellar lamella is bent at a comparatively obtuse angle, being slightly (*suttoni*) or fairly visible in the aperture. The palatal swelling below is of the shape of a whitish, sometimes triangular tubercle, not at all or scarcely perceptibly prolonged inwards into the aperture; hence the lower palatal plica is not differentiated in this case. The lunella is nearly straight, flattish but very wide in comparison not only with Central European but also with W. European forms of *Pirost. dubia*; the upper part of the lunella is sometimes differentiated, forming the beginning of the upper palatal plica. The principal palatal plica reaches distinctly beyond the lunella.

The plate of the clausilium in *cravenensis*, as has been already partly pointed out by J. D. Dean (*J. of Conch.*, XIV, 1914, p. 161) is relatively broader and less bent than in the common *dubia*; from above it appears to be more flattened, from below it is grooved, without any distinct outer angle.

The aperture, especially in the more slender specimens, is not large, comparatively narrowed and elongated upwards; sinus wide, often placed fairly high, the upper margin of the aperture being in that case markedly oblique. Peristome but little thickened, feebly dilated and reflexed.

British specimens in which the "nivellation" of the subtle sculpture of the surface of the shell as well as of the armature of the aperture

and of the clausilium is most strongly expressed, have been separated under the name var. *suttoni* Wstld.; they represent merely an excessive but zoogeographically not independent form of the subspecies *cravenensis*; its contrast is furnished by sporadic specimens of *cravenensis* which resemble central European forms.

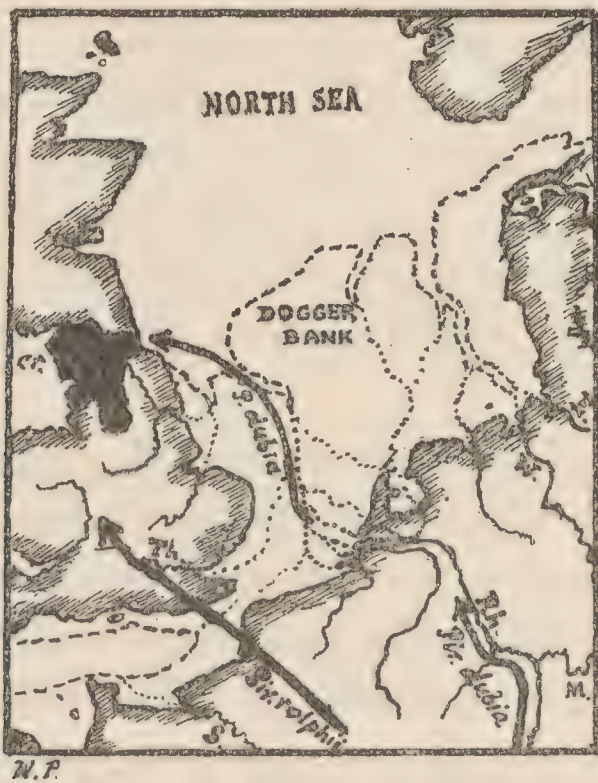
The subspecies *cravenensis*, which differs from all Central European subspecies and local forms of *Pirostoma dubia*, which are almost completely represented in the Polish Museum of Zoology (collections of A. J. Wagner and W. Polinski), differs also from the forms of North Central Europe. The farthest North-Eastern Polish form from the hills of Wilno, at the climatic limit of Western and Eastern Europe, resembles still strikingly the Carpathian form and differs from *cravenensis* by smaller dimensions (10.8-13 mm.), by its swollen shape, by the striation, by the indistinct lower palatal swelling and the well developed lower palatal plica on the other hand, and by the typically step-like inferior lamella of the aperture. The Swedish, Danish and North German specimens are already somewhat nearer but they differ also by their dimensions, their striation, by the lower palatal plica, by the higher spiral lamella, and by the narrower and more arched lunella. The form *fagotiana* Bgt. from the hills of Hautes Pyrénées, fairly resembling *cravenensis* in shape, has the lower lamella not so straightened and the lunella more arched; the subcylindric specimens of forma *gallica* Bgt. from the valley of Lys, Haute Garonne (13-14.2 mm.) differ besides other characters by their subcolumellar lamella which is bent within the aperture at a right angle.

The obsoletism of the inferior lamella and of other parts of the aperture of the shell, which is marked not seldom in *dubia* in the damp forests of the Alps and of the Carpathians, is being met with more frequently as we move westwards and north-westwards; in the region of the middle Rhine the form *obsoleta* A. Schm. becomes in many localities dominant, acquiring the character of a subspecies. This Rhine form differs from typical *cravenensis* by its smaller dimensions (specimens which I have measured: length, 11.2-14.5 mm., 10-11 1/2 whorls), by the shorter and more stoutish shape, by the paler colour, by the striae more often ornamented with whitish streaks below the suture, by the narrower lunella and by the lower palatal plica somewhat prolonged into the aperture; the other characters of the aperture and especially the sculpture of the surface resemble fairly vividly, on the contrary, the subspecies *cravenensis*. Excessive obsolescence, still more developed than in the subspecies *cravenensis* var. *suttoni*, which is connected probably not only with the climate but also with the substratum, is shown in specimens from certain localities in the

Schwarzwald (e.g. from Allerheiligen, comm. D. Geyer) which differ from those from S.W. Germany only by their still denser striation.

PIROSTOMA DUBIA OF DOVER.

The specimens from Dover, very kindly forwarded to me by Mr. H. Overton, show clearly that the form of *dubia* at Dover is by no means identical with the subsp. *cravenensis* and approaches closely the western continental forms. The general shape and the most delicate and exceedingly dense striation is almost the same as that of Dutch specimens, although the dimensions are a little larger (examples measured by me: 12.9-13.2 mm.). The number of whorls is less than in subsp. *cravenensis*, the apical part of the shell not so elongated and the sinulus lower. The inferior lamella is less oblique in relation to the superior one and not so much diverging from it; moderately but distinctly step-like broken and sometimes ending with a long bifurcation on the peristome. The lower palatal swelling has usually the form of a narrow and long plica, distinctly directed inwards, as never seen in subsp. *cravenensis*, but similar to continental *dubia* (except the most obsolete forms).



The ways of invasion of *Pirostoma dubia*
and *P. rolphii* to England at the period
of Late Pleistocene, resp. Holocene.
(The approximate coast-line of the North Sea
and the estuaries of the rivers at that period
are drawn after the fig. 4 in the „Submerged Fo-
rests“ by Cl. Reid, 1913).

ORIGIN.

1. From the zoogeographical point of view the absence of *Pirostoma dubia* from North-Western Spain, from the whole Western Central and Northern France, from Ireland and South England (the Castle of Dover cannot be taken into consideration) excludes the possibility of the arrival of the above mentioned species to the British Islands from the South, as should be admitted for instance for *Pirostoma rolphii* Leach.

2. The following facts lead to the conclusion that *Pir. dubia* arrived in England from the E.S.E. direction and that its arrival has been promoted by the Rhine: (a) the closest resemblances and differences in relation to continental forms, which have been analysed already above; (b) the colonies of *Pir. dubia* f. *obsoleta* in Holland exclusively along the branches of the Rhine, resembling much the forms from the Schwarzwald and from other countries of the region of the Middle Rhine; they represent a striking zoogeographical analogy with the Carpathian form of *Pir. dubia* settled by the Vistula near its delta; (c) the frequency of *dubia* often obsolete already in the middle Pleistocene of the region of the middle Rhine; (d) the appearance of *Pir. dubia* in England only in the upper Pleistocene (Kennard in "Proc. Mal. Soc." 1924) and only in the North of England.

The two above conclusions lead to a third which summarises the results of the above study.

3. *Pirostoma dubia cravenensis* Taylor appears to be an endemic N. English subspecies, differentiated in a fairly recent phase of the quarternary; it arose from the obsolete form of *dubia*, which reached England through the intermediation of the Rhine from the mountains of its middle region, at a time when the North Sea formed merely a gulf of the North Atlantic and the Rhine had its mouth at the latitude of Yorkshire west of the Dogger Bank.

The form of *dubia* living at Dover arrived in England by another way and considerably later than the northern one, as proved by its much closer resemblance to the western continental forms.

A comparison of the area of distribution with the geological map indicates clearly that the British region of expansion of *Pir. dubia* and of its taxonomic differentiation in that country is the North English rocky and mountainous territory of the Carboniferous, Permian and Triassic limestone; the contemporary subspecies *cravenensis* reaches its Western and Southern limits. The influence of the above mentioned territory combined with the action of the damp sea climate formed a quite peculiar and unique combination of bionomic factors;

this double influence explains also the unique combination of sub-specific characters nowhere else met with within the limits of this species; on the one side the large size, on the other the peculiarly expressed obsoletism of the aperture and the characteristic sculpture of the surface of the shell.

EXPLANATION OF PLATE VII.

1-6 *Pirostoma dubia* Drap. $\times 10$ (1) Vesicula seminalis (specim. from Zutphen, obsolete form); (2-4) Spermatheca, various forms (Zutphen; Pol. Jura); (5) end of the diverticulum of the spermatheca duct (Pol. Jura); (6) genital apparatus (Zloty Potok in the Pol. Jura).

7, 8, 9, 12. *Pirostoma dubia cravenensis* Tayl. (Craven Highlands)
(7) Genital apparatus $\times 10$; (8) ves. seminalis $\times 10$; (9) clausilium; (12) shell $\times 5$.

10-11 *Pirostoma bidentata* Ström. Rozewie on the Polish Baltic coast; $\times 10$.

(10) genital apparatus; (11) spermatheca of another specimen:—
h.gl. hermaphrodite gland; *h.d.* hermaphrodite duct; *v.s.* vesicula (ovo-) seminalis; *a.gl.* albumen gland; *pr.* and *ov.* spermoviduct (prostate and uterus); *v.d.* vas deferens; *ep.* epiphallus; *p.* penis; *g.a.* genital atrium; *di.* diaphragm; *p.r.m.* penial retractor muscle; *m.* muscles; *vag.* vagina; *sp.* spermatheca (receptaculum seminis); *sp.d.* spermatheca duct; *div.* diverticulum of the sp. duct; *f. ov.* free oviduct.



HYALINIA RADIATULA FOUND ON CARNIVOROUS PLANTS.

By G. H. RODMAN, M.D.

(Read before the Society, December 7th, 1927).

WHILST engaged upon the investigation of the animal contents of the pitchers of various *Nepenthes* in cultivation at the Royal Botanic Gardens, Kew, I, on three occasions, found specimens of *Hyalinia radiatula* (kindly examined and named for me by Mr. J. C. Dacie) in a new pitcher, *i.e.* one of that season's growth, of *Nepenthes phyllamphora*. This was in May, 1925. A month later in a pitcher of *Nepenthes hainanensis* a collection of five of the same species of molluscs was present. In this instance the shell walls were softened by the *acid* solution present in the pitcher which contained other animal (insect) remains undergoing the digestive process.

In July of the same year in the *Nepenthes* house at Kew I found in a pitcher of *Nepenthes masteriana*, amongst the remains of Millipedes and Dipterous flies, further examples of *Hyalinia*.

As far as I have been able to learn no previous record of finding shelled molluscs in pitchers has been made. Mr. Scaun of the Herbarium, Kew, who lived for a number of years in the East amongst *Nepenthes* had never observed their presence though he tells me that "slugs" were commonly found in the pitchers.

Prof. J. Macfarlane of Philadelphia, a recognized authority upon carnivorous plants including the *Nepenthes*, was unaware that shelled molluscs were ever found in the *Nepenthes* receptacles.

In view of the fact that *Hyalinia* are known to be carnivorous feeders it would seem that their occurring in pitcher plants is explained by their being attracted there by the presence of the decomposing animal matter—raiders of the food supplies of the plant in fact—this suggestion is borne out by the finding of a specimen of *Hyalinia radiatula* on the opened leaf of Venus' Fly Trap (*Dionæa muscipula*).

In this case the mollusc was apparently attracted by the chitinous remains of a beetle which the plant had been unable to digest and which was on the same re-opened leaf upon which the snail was found on Oct. 7th, 1926.

NOTES ON THE LAND MOLLUSCA OF THE LLANDUDNO DISTRICT.

By W. E. ALKINS, M. Sc.

(Read before the Society, September 10th, 1927).

THE writer spent a holiday of ten days at Llandudno in the latter half of June, 1927, when such opportunities as were offered by an exceptionally cold and wet spell were taken to look for land mollusca. The observations made do not entirely agree with those put on record by H. Beeston in this Journal (*Journ. of Conch.*, vol. 16, pp. 128-132, 138-144), and it is hoped that the following brief notes may therefore be of interest.

Beeston's paper, read in March, 1917, was compiled from records made by himself in 1901 and 1915, with the incorporation of earlier observations of W. D. Roebuck, J. R. le B. Tomlin and A. J. Nixon, and of several notes by C. E. Wright. The appearance of the paper in January, 1921, called forth a note on "*Pomatias elegans* at Llandudno" from A. K. Lawson (*Journ. of Conch.*, vol. 16, p. 227).

Circumstances confined the writer's observations to the immediate neighbourhood of Llandudno, and indeed almost entirely to the slopes of the Great Orme adjacent to the eastern portion of the Marine Drive. Records were therefore very incomplete, and the following notes are to be regarded as supplementary only to those of Beeston.

Limax maximus Linné. Several at foot of cliffs, east end of Marine Drive.

Vitrea rogersi B. B. Woodward. Above Happy Valley Rock Gardens, Great Orme.

Helicella barbara (Linné). The largest specimens taken were found in a small roadside area by cottages near the Gogarth Abbey Hotel on the West Shore, where they had plenty of cover from vegetation, in which the Barley-grass (? *Hordeum murinum* Linné) was conspicuous. The species was very numerous here, and attained a length of 15 mm.; all the shells seen were unicolorous.

Hygromia hispida (Linné). Fairly general, Happy Valley and Marine Drive, but by no means abundant.

H. striolata (Pfeiffer). Amongst nettles near Putting Green, Happy Valley. Abundant amongst nettles and brambles near houses, short distance above West Shore Lodge, Marine Drive.

Helix aspersa Müller. Common on grassy slopes at foot of cliffs, both sides of Marine Drive, Great Orme, and often to be seen about the streets of the town after rain. Variable in size and marking, but remarkably constant in colour.

H. nemoralis Linné. Taken in August, 1926, by Deganwy-Conway road near Llandudno Junction. Common at foot of limestone cliffs and on grassy slopes, both sides of Marine Drive, for about a mile from Happy Valley (east) Lodge; frequent among nettles, seaward side of Drive. The most characteristic feature of the shells taken on the Great Orme was the frequency with which the upper bands were absent, shells with the band formulæ 00345 and 00045 or some variant representing rather more than 25 per cent. of the whole. The form *olivacea* Risso 00000, apparently typical of the limestone districts of Staffordshire and Derbyshire, occurred, but only sparingly. The colour forms *libellula* Risso and *rubella* Picard occurred in roughly equal numbers, the variety *castanea* Picard, in several shades, being much less frequent. In addition to the typical formula, 12345, and varieties derived therefrom by coalescence, the following band formulæ were taken :--

var. *libellula* Risso :—02345; 10345; 00345; 003(45); 003(45) (third band colourless); 00(345); 00045; 000(45); 0004.; 00300.

var. *rubella* Picard :—10345; 00345; 00.45; 003(45); 003.; 00300; 00300 (var. *fasciata* Picard); 00000 (var. *rubra* Baudon).

There is considerable variation in detail in the banding of the shells assigned to the formulæ 00345, 00045 and variants.

var. *castanea* Picard :—10345; 10300 (in this shell the first band is very narrow, but is present from an early stage); 020(45) (the second band is very narrow, but is visible from an early stage; the shell has a pale peripheral band, which gives it an unusual appearance).

H. hortensis Müller. A small colony was found in a damp area between the Marine Drive, Great Orme's Head, and the foot of the cliffs above the road, about three-quarters of a mile from the East Lodge. All the shells seen were typical, with some tendency to coalescence of the fourth and fifth bands, with the exception of a single specimen referable to the form *olivacea* Taylor (a pale shade near var. *griseo-brunnea* Esmark as illustrated in Taylor's Monograph, vol. III, Pl. XXVIII) *fuscolabris* Kregl. with band formula 123(45).

Pomatias elegans (Müller). Several small colonies at the foot of the cliffs above the Marine Drive for about two miles from the East Lodge. The most numerous colony was associated with *H. hortensis* in the locality above described, where the species was repeatedly observed crawling out over damp moss. Elsewhere it was found by pulling away grass roots immediately at the foot of the limestone cliffs.

EDITORIAL NOTES.

At the Annual Meeting held on October 20th at University College, London, H. H. Bloomer was elected President, and J. D. Dean, A. W. Stelfox, C. H. Moore, R. Harrison, H. Coates and A. K. Lawson, Members of Council. The other Officers were re-elected without change.

We have been requested by the Director, Dr. A. J. Wagner, to take note that—by a decree of the President of the Polish Republic, dated 29th February, 1928—the title of the Polish Museum of Natural History at Warsaw has been altered to Polish Museum of Zoology.

The Commemoration Medal of the Belfast Naturalists' Field Club, awarded annually for materially contributing to some branch of natural science or archæology, was presented last month at the annual conversazione to Mr. R. J. Welch.

The first civil pension granted by the Government of Northern Ireland for meritorious public service has also been awarded to Mr. Welch, in recognition of his contributions to the knowledge of Irish natural history and archæology.

A paper by Major Paul Dupuis in the Ann. Soc. Royale Zool. de Belgique, lviii, 31-38, announces the recent addition of *Assiminea grayana* and *Hydrobia jenkinsi* to the Belgian fauna by Dr. Giltay. The latter record rests on a single dead, discoloured example of the keeled form, taken on the left bank of the Schelde, opposite Antwerp. The *Assiminea* has occurred on 4 different occasions, also in the Antwerp neighbourhood, 18 specimens in all having been taken. They were presumably alive, though this point is not actually mentioned.

A recent study by Bartsch and Quick in the Journal of Agricultural Research (Washington, D.C.) xxxii, No. 8, comes to the conclusion that *Zonitoides arboreus* (Say) is largely responsible for the sugar-cane root disease in Louisiana, in spite of the unusual mode of feeding. Its usual habitat is under loose bark or amid any vegetable detritus, but it has been found living in worm-burrows at the roots of the cane, feeding on the roots and thus admitting infection and decay.

Three very serviceable faunal lists deserve attention: (1). Dr. Boycott's "Land Snails at Nevin" (N. W. Naturalist, Dec. 1927): he found the cliff a much richer locality than the ground a mile or more inland and gives probable reasons for this discrepancy.

(2). Mr. J. W. Taylor's L. & F. W. Mollusca of West Yorks. in the General Handbook for the Leeds meeting of the Brit. Association (1927). In addition to a summary of this fauna, a short account is given of the origin of the *Journal of Conchology* and the Conchological Society, and of the very rich Mollusca collections in the Leeds City Museum.

(3). Mr. J. D. Dean's "Non-Marine Mollusca of Glamorgan" in the Trans. Cardiff Nat. Soc., lix, pp. 59-75. The total number of species is at present 118. The named varieties are fully dealt with, and the Pleistocene deposit at Leckwith Hill is noted which produces *Lauria anglica* and 3 kinds of *Vertigo*, *pusilla*, *angustior* and *albestris*,—none of them so far taken alive in the county.

In the Journ. Marine Biol. Assoc. U.K. xv, No. 2, pp. 683-702, Mr. A. C. Stephen details an intensive study of *Macoma tenuis* (da Costa), made in Kames Bay, Cumbrae Is. Statistics are given as to range and density, rate of growth, comparative abundance of *tenuis* and *fabula*, with many interesting details on such points as mortality, annual increment of growth, and spat fall. The food usually consists of vegetable detritus, but during the spring increase diatoms appear almost exclusively in the gut. The usual density at low water is 760 to 1000 per $\frac{1}{4}$ sq. metre, but on one occasion 1897 were counted! It was found that the larger individuals occur in the upper reaches, while at lower levels the smaller sizes predominate. This is the reverse of what has been found in the case of *Mytilus edulis* and *Patella vulgata*.

The Ministry of Agriculture and Fisheries last year published a most instructive "Report on the Cockle Beds and the Cockle Industry of England and Wales" (Fishery Investigations, ser. II, vol. IX, No. 5) by F. S. Wright of the Fisheries Laboratory, Lowestoft. The chapter on the natural history of the cockle is of most interest to us; it summarises the distribution, life history, structure, general natural history, enemies and destructive influences.

Immense havoc is often caused by frost, and cockles lying on the surface are often killed by the sun's rays in summer. The destruction wrought by gulls and other sea-birds is, broadly speaking, not very serious. The Shore Crab (*Carcinus mænas*) is very destructive to young cockles. The statement in some works on Mollusca that the Mussel and Cockle attain their full growth in a year is definitely contradicted as far as concerns our common *Mytilus edulis* and *Cardium edule*.

Dr. A. J. Wagner, Director of the Zoological Museum at Warsaw, died on June 11th last, at the age of 68. He was probably known best for his writings on palæarctic *Clausilia* and *Hartmannia*. He was also the author of many papers on the land-shells of Europe, and of a monograph of *Helicinidæ*, in which the classification is largely based on the characters of the operculum.

Mr. S. Raymond Roberts of Glen Ridge, N.J., died on August 19th, a few days before his 83rd birthday. His chief interest was in the Cypræidæ and he was the author of the monograph on this family in Tryon's Manual, vol. VII. His collection of Cowries goes to the Philadelphia Academy of Nat. Sciences.

The Canadian Field-Naturalist XLII, No. 6 (for last September), in an article by G. D. Sprot on "The early Indian Wildfowler of Vancouver Is.", describes a novel substitute for bird-lime. The younger generation of Indians, it seems, has been known to use the slime of "the large wood slug (*Limax*)" for coating twigs to catch the Rufous Humming-bird (*Selasphorus rufus*). A detailed account of this is given by a Mr. Hillier, who witnessed the process in his own garden: one coating of slime on the branch of a Salmon-berry bush, which is attractive to humming-birds, was sufficient to catch a number of them.

"The Species Problem: An Introduction to the Study of Evolutionary Divergence in Natural Populations," by G. C. Robson, M.A.

This volume is No. 8 of the series of biological monographs and manuals now being published by Messrs. Oliver & Boyd, Paternoster Row, and is an admirable addition to the books on evolution, presenting as it does the latest data and theories in a most convenient and up-to-date form. The ever-increasing literature and the

ever-widening field of study make such a work from time to time indispensable, and when it is done as efficiently and comprehensively as in this case, it forms a textbook that will take a lot of superseding. The author, as a zoologist, has written largely from the zoological point of view, but by no means to the shelving of plant evidence, and botanical data are much in use.

Robson can discover no universal criterion of specific status, but the groups designated by systematists as species can be profitably discussed because they are known to consist of many individuals having certain characters in common. The inadequacy of the information or material on which the systematist frequently founds his species is a point of criticism fully dealt with, and the author very happily describes the groups recognised as species—however diverse their relationships and attributes in degree—as episodes in evolution.

A matter much emphasized is the neglected study of habitats and the necessity for intensive collecting.

There are special chapters devoted to isolation as a factor in divergence, to the distribution of allied species and to the origin and spread of variant characters.

The Proc. Isle of Wight Nat. Hist. Soc. for 1926, vol. I, pt. vii, p. 465 record the discovery of two dead shells of *Cymatium nodiferum* Lam. with periostracum in fresh condition. It is known that many living specimens were thrown overboard from a trawler off Shanklin at the beginning of the war.

I have a note from the late Mr. H. C. Burnup correcting two errors in an exhibit mentioned in the current volume of this Journal, p. 56. The locality of *Achatina burnupi* should be Van Reenen, Drakensberg. *Metachatina kraussi* should be ascribed to Pfeiffer; *Achatina kraussi* of Reeve is merely a colour-var. of *zebra* Fér. and does not live in Zululand.

Margaritana margaritifera in Pembrokeshire.—In his account of the distribution of the Pearl Mussel in Britain (*Journal of Conchology*, vol. 17, p. 205) Mr. J. W. Jackson cites C. G. Barrett as authority for its occurrence in 1888 in the "River Cleddau." It may be worth while to particularize. The two chief rivers of Pembrokeshire are the Eastern and the Western Cleddau. The latter is tidal below Haverfordwest, the former below Blackpool, about a mile and a half southwest of Robeston Wathen. The conjoint tidal creeks form near Landshipping the main arm of Milford Haven. In June, 1927, after a long drought, I noticed dead shells of *margaritifera* on the shingle-banks in the Afon Syfynwy, the principal affluent of the Eastern Cleddau, as well as in the main stream above the place where the waters meet near Egremont, and in the Cleddau from that place past Llawhaden and down to Blackpool. A single dead shell was found in the Western Cleddau a mile and a half above Wolf's Castle.—CHAS. OLDHAM (*Read before the Society*, 10th Sept., 1927).

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND.

564th Meeting, held at the Manchester Museum, April 14th, 1928.

Mr. G. C. Spence in the chair.

Additions to Cabinet.

Specimens of *Alopiæ canescens sabinæ*, and *Alopiæ nefasta helenæ*; also photos of monstrosities of *Gyraulus gredleri* from H. Schlesch.

Additions to Library.

"The Cephalopoda of the Irish Coast," by Anne L. Massy.

"Notes sur l'*Hydrobia jenkinsi*," by H. Schlesch.

"Nye Bidrag til Fyns Molluskfauna," by Kierulf Petersen (from the respective authors).

Exhibits.

By Mr. B. R. Lucas :—A series of shells from Chara Marl at Kirkby Fleetham, Yorks.

By Mr. J. W. Jackson (for Manchester Museum) :—A collection of marine shells from Kilifi Creek, 32 miles N. of Mombasa, East Africa (coll. R. Franklin).

The Special Exhibit was "Abnormal British Helices."

565th Meeting, held at the Manchester Museum, May 12th, 1928.

Mr. G. C. Spence in the chair.

Additions to Library and Cabinet.

"Om *Sepia officinalis* L.", by Hans Schlesch.

"On the Cephalopoda of the Natal Museum," by A. L. Massy (from the respective authors).

American Philosophical Society; Bicentenary Celebration, 1927. (from the Society).

Viviparus viviparus (L) from Denmark (donor, H. Schlesch).

Member Deceased.

W. Harrison Hutton.

Papers Read.

"On *Pirostoma dubia cravenensis* Taylor: its affinities and its Geographical Origin," by Dr. W. Polinski.

"Notes on British Clausiliidæ," by J. G. Dalglish.

"Notes on British Mollusca: August and September, 1927," by A. Gardiner, B.Sc.

"Cases of marked preference of certain Mollusca for particular algæ, zones, etc.," by A. Gardiner, B.Sc.

"On the Identity of *Clausilia cravenensis* Taylor with *Clausilia suttoni* West-erlund," by J. D. Dean.

"*Vitrina major* in Gloucester East," by A. E. Boycott.

Exhibits.

By Mr. C. H. Moore :—*Cochlicopa lubrica* Müll. and *Azeca goodalli* Fér. from various localities.

The Special Exhibit was *Clausilia cravenensis* Taylor.

566th Meeting, held at the Manchester Museum, September 1st, 1928.

Mr. C. H. Moore in the chair.

Candidate Proposed for Membership.

Mrs. Ida Shepard Oldroyd, Dept. of Geology, Stanford University, California, U.S.A. (introduced by H. C. Fulton and S. G. Finch).

Members Deceased.

H. C. Burnup.

Dr. A. W. Rowe.

F. L. Button.

Papers Read.

"A Garden Fauna," by A. E. Ellis.

"A large *Bithynia tentaculata* from the Foss, York," by Mrs. Morehouse.

Punctum pygmæum var. albina in Britain.—*Punctum pygmæum* lives in incredible numbers among the dead beech leaves in the woods of the Chiltern Escarpment, where it is associated with *Euconulus fulvus*, *Hyalinia crystallina*, *Acanthinula aculeata*, *Sphyradium edentulum*, *Carychium minimum* and *Acicula lineata*. Among several hundred *pygmæum* obtained from a bag of leaves gathered last March at Aston Clinton, Buckinghamshire, were two shells, albinos to all intents and purposes, for, although they had a faint and elusive suggestion of brown in some lights, the protoconchs were colourless and Mr. Tomlin agrees with me in referring these individuals to Reinhardt's var. *albina*.—CHAS. OLDHAM (*Read before the Society*, 10th Sept. 1927).

Paludestrina jenkinsi in Orkney and Caithness.—This adventurer has now reached the north of Scotland. Last July it was abundant in the brackish Loch of Stennes and the adjacent, freshwater Loch of Harray, near Stromness, Orkney. It occurred sparingly on the Ackergill Links near Wick, in the stream that drains the Loch of Wester, and in abundance in the Loch of Mey, a shallow lake near the sea on the north coast of Caithness. I could not find it in St. John's Loch, four miles to the westward nor in any of the other Caithness lochs that I searched, *i.e.* Calder, Olginney, Scarmclate, Watten, Hempriggs, Yarrows, Sarclet, and the lochans on the headlands of Holborn and Dunnet, but some at any rate of these will probably be invaded ere long.—CHAS. OLDHAM (*Read before the Society*, 10th Sept., 1927.)

On the name **Syrnola gracillima**.—Two species have been so designated, viz. *S. gracillima* A. Adams, Ann. and Mag. N.H., (3) V. 405, 1860 from the Straits of Korea—the genotype of *Syrnola*—and *Obeliscus (Syrnola) gracillima* Smith, P.Z.S. 1871, 734, pl. lxxv, f. 17, 1872, from Whydah. The latter is also a *Syrnola* and may be re-named *S. whydahensis*.—J. R. LE B. TOMLIN.





dubia & *v. speciosa*
(Schmidt)

Warton
cravenensis

dubia (var.)
Kandersteg

Stow Wood
cravenensis



Westerlund's type of *dubia* var. *suttoni*.



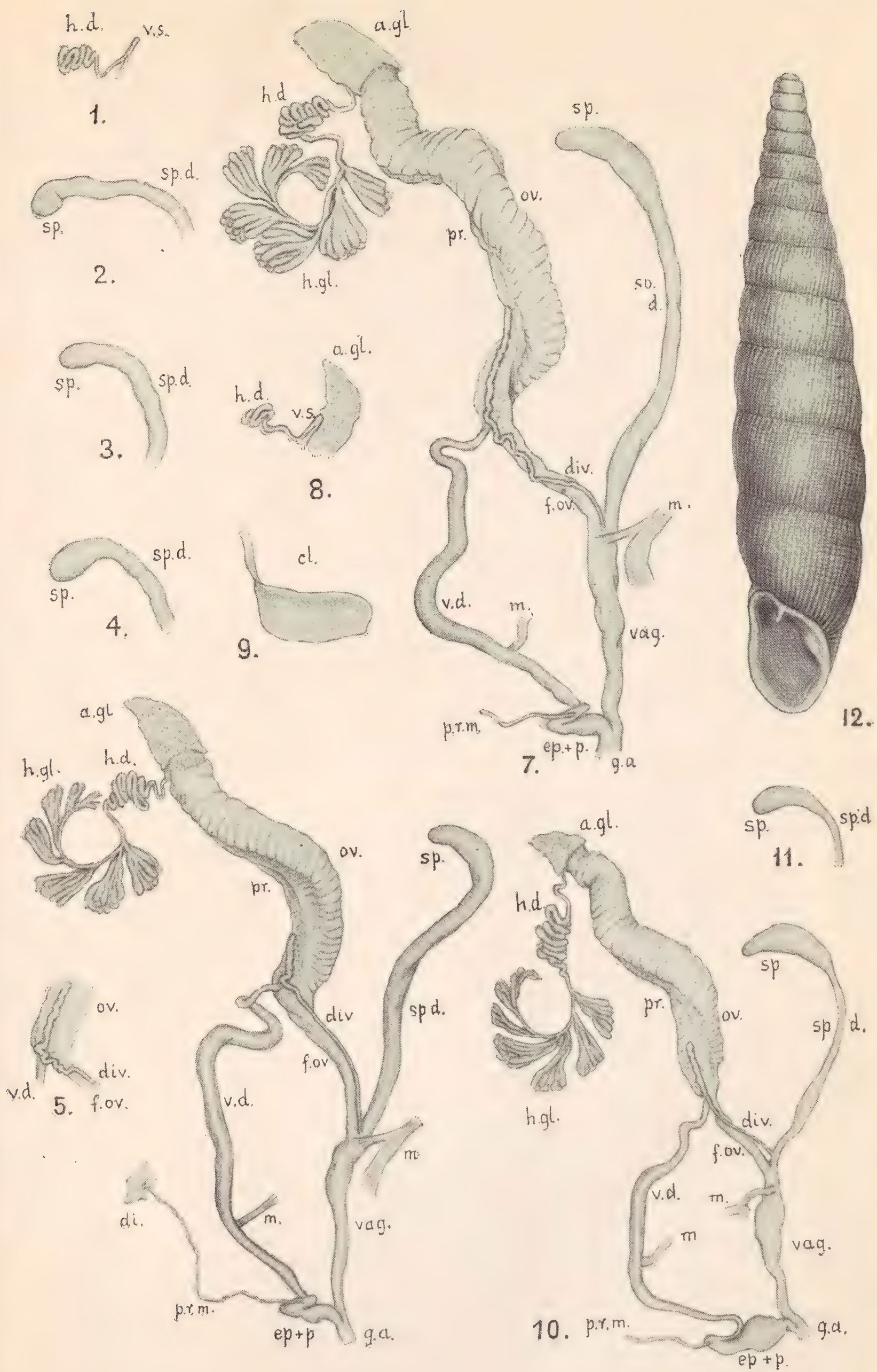
v. schlechti
Höllental

v. druidifica
Brittany

dubia
Dover

v. vindobonensis
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VOL. 18.

APRIL, 1929.

No. 10.

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-

New Members, Resignations, and Deaths, will be found in the Proceedings,
 pp. 243-7, 271-2.

Vitrina major in Gloucester East and its eggs.—On April 10th, 1928, I found two characteristic examples of *V. major* in Humblebee Wood, two miles south from Winchcomb on the road to Charlton Abbots and immediately below the long barrow known as Belas Knap. It is an ash-beech-hazel wood, highly calcareous and on so steep a slope that it can never have been cultivated: a dead *Ena montana* supports the idea that it is ancient woodland; *Limax maximus* was present and, therefore, *L. cinereoniger* was probably absent (*Proc. Malac. Soc. London*, vol. xiv, 1921, p. 167). Mollusca were abundant, *H. striolata* and *Cl. laminata* predominating among the 27 species which were found without any thorough search, and included *Cyclostoma elegans* and *Vitrina pellucida*. In captivity the larger specimen laid a heap of 25 soft white sticky eggs under a dead leaf on June 5th; they had not hatched on June 28th, when they were eaten by some fly larvæ. On an average the eggs measured 1.35 mm. long and 1.07 mm. wide which is about the same size as *pellucida* eggs and entirely discrepant with Moquin-Tandon's statement (*Histoire Naturelle* vol. II, 1855, p. 51) that the eggs of *major* are "about 0.33 mm. in diameter," a minute size which would be in harmony with the curious structure of the oviduct (*Proc. Malac. Soc. London*, vol. xv, 1922, p. 127) but seems as likely as not to be a misprint for 1.33. The parent was finally killed and dissected and its specific identity verified from its anatomy.—A. E. BOYCOTT (*Read before the Society*, May 12th, 1928).

DESCRIPTION OF *DRYMÆUS WINTLEI*, n.sp.,
FROM ECUADOR.

By S. G. FINCH.

(Read before the Society, November 7th, 1928).

Drymæus wintlei, n.sp.

SHELL very narrowly umbilicate, ovate-pyramidal, moderately solid, almost smooth, with fine longitudinal striæ or lines of growth; apex blunt, nepionic whorls white, with close-set, minute, thimble-like punctures; whorls $5\frac{1}{2}$, moderately convex, opaque-white with two or three black-brown spiral bands; aperture long ovate, a little exceeding half the length of the shell, whitish within, exterior markings shewing through; peristome expanded, white.

Type, alt. 21.5, diam. 9 mm.; aperture, alt. 11.5, diam. 7 mm.

This species is allied to *D. subsimilaris* Pils., but is more solid, slightly smaller, white instead of lilac-purple interior, peristome thicker and more expanded, aperture rather more elongate.

A large number of both species was collected by the late Mr. Clarence Buckley in Ecuador. For many years *D. wintlei* has been distributed as *D. castus* Pfr., from which it may at once be separated by its slender appearance, more solid shell, and by the absence of the spiral striæ, so conspicuous under a lens in *castus* and *subsimilaris*.

I have much pleasure in naming this species in honour of W. J. Wintle, Esq.



DRYMÆUS WINTLEI Finch.

Ecuador.

Natural Size—left hand specimen is the type.

THE LAND MOLLUSCA OF KENT.

BY A. S. KENNARD, A.L.S.

(Presidential Address read at the Annual Meeting, October 20th, 1928).

AT the present day students of the mollusca have several lines of research from which to choose their work. Anatomy, which in the hands of my predecessor has yielded such brilliant results, has many devotees, ecology (an ugly but useful term) is attracting many of the younger men, whilst palæoconchology still maintains its fascination. As a rule the choice is determined by chance and it was a casual visit to the well-known Pleistocene deposits at Crayford that first drew my attention to the geological history of our non-marine mollusca. I am afraid that at that time I was more attracted by the æsthetic side than by the problems that the shells presented, but as more and more deposits were examined their importance in helping to solve many of the enigmas of distribution became manifest. I would, therefore, crave your indulgence whilst I deal with the land mollusca of Kent in Holocene times and endeavour to distinguish the true native from the alien even when the species has been naturalized for centuries, and to note the waxing and waning of species from unexplained causes. Only one reason can be adduced for the use of the comital and vice-comital divisions of H. C. Watson for distributional registration and that is convenience.

Kent is only a political entity, for though on the North the Thames does form a definite boundary so far as land mollusca are concerned and a still larger part of its confines is the sea, yet on the west the dividing line only exists on maps and animals can wander from Surrey or Sussex into Kent at their own sweet will. Following tradition Kent is divided into two parts, East and West, the line of demarcation being the rivers Medway and Beult and a main road. At the present day a main road must be an almost insuperable barrier to the land mollusca but the division is so purely arbitrary that it is better to ignore it and consider Kent as an unit. Though I have used the phrase land mollusca I do not include the slugs. Though their remains are fairly common in a fossil state yet their identification is too often a happy guess. With the *Arionidæ* specific determination is impossible whilst only one fossil example of *Testacella* has yet been found on these islands, *T. haliotoides* Lam. in a Holocene deposit at Porlock Weir.

I take this opportunity of thanking my many friends who have so kindly assisted me, and I would particularly mention Dr. E. W. Bowell, C. S. Carter, W. H. Cook, J. E. Cooper, J. C. Dacie,

F. Hugh Gripper, H. C. Huggins, J. W. Jackson, Mrs. Longstaff, R. Winckworth and B. B. Woodward.

THE RECENT FAUNA.

We have first to ascertain the species that may be considered resident in the county. Our present knowledge is the result of the labours of many workers. Dr. Martin Lister was the first recorder and he noted *Pomatias elegans* (Müll.) and *Theba cantiana* (Mont.). There is no need to enter into the details of the growth of our knowledge but a tribute should be paid to W. Boys, who added so many species to the English list, and to whose knowledge and enthusiasm Montagu again and again pays tribute. The fullest list was published by B. B. Woodward in 1908 (Victoria County History of Kent, pp. 99-101), whilst the merits of the census published as a memorial to W. D. Roebuck must be emphasized. Using the census as a basis and by carefully examining other records and material we have a total of sixty-one species that have been found living in the county, the full list being given in the table which accompanies this. In addition *Subulina octona* (Brug.) has been found at Dover and *Opeas pumilum* (Pfr.) at Bromley, both in greenhouses, but these two species are not true constituents of the fauna. Similarly *Helicella draparnaldi* (Beck) lives in my garden at Beckenham and I have no doubt in many other gardens but it must be regarded as an exotic, as it undoubtedly is in England, except in the south-west.

I have included five species that are not recorded for the census viz. :—

Vertigo pusilla (Müll.)

„ *substriata* (Jeff.)

Columella edentula (Drap.)

Zenobiella subrufescens (Mill.)

Laciniaria biplicata (Mont.)

I have seen examples of *Vertigo substriata* from Westerham and Tunbridge Wells, of *Columella edentula* from Keston, Ashurst and Tunbridge Wells and of *Zenobiella subrufescens* from Kemsing. It appears from Montagu that the first examples of this species were sent to him by W. Boys and thus probably came from Sandwich. *Vertigo pusilla* was found by W. Boys under ivy on old walls at Sandwich and was described by Montagu as *Turbo vertigo* (Test. Brit. p. 393, pl. xii, fig. 6) but has not been found living since. *Laciniaria biplicata* was obtained at Deptford Creek many years ago by that careful collector J. Pickering, and though I fear the colony has long been destroyed it has an undoubted right to a place in the list. The commercialization of the south bank of the Thames has been the cause of the local extinction of several interesting species.

There are several records that I have rejected including *Ena montana* (Drap.) and *Euparypha pisana* (Müll.). The former has been recorded from Kent without precise locality, but until it has been confirmed the record is better ignored, whilst the latter unless introduced is an extremely improbable entry.

THE HOLOCENE FAUNA.

I have not ventured to discuss the Pleistocene mollusca though they are noted in the table for there is so much divergence of opinion as to whether there was any large survival of species from that period to the Holocene. The subject is an extremely complicated one and the evidence apparently contradictory, so to-night I shall only deal with the Holocene deposits, where we are on safer ground. In the table I have divided these deposits into Pre-Roman, Roman and Post-Roman. Our knowledge of the Pre-Roman fauna cannot be considered as complete. The evidence is derived from a number of rainwashes on the escarpment of the North Downs, or in the Medway Valley, and swamp deposits at Crossness, Deal and Ightham, so that we have no evidence at all from a very large area. The discovery of a rich fossiliferous deposit in the inner Weald would indeed be welcome.

Archæological diggers in Kent do not appear to appreciate the scientific value of the mollusca and from that source I have obtained no assistance, though from the diggings I have personally collected most important evidence. This neglect is in marked contrast with the great assistance I have received from archæological workers in Hampshire, Norfolk, Sussex and Wiltshire. It must be admitted that the grouping of certain deposits as Pre-Roman is capable of improvement but in our present state of knowledge it is the only possible course. It covers a much longer period than the two remaining divisions and witnessed at least four changes in climate, and these changes must have affected the mollusca.

Some of the deposits can be definitely assigned to the Lower Turbarian of Prof. James Geikie, the extremely damp period that occurred in the Neolithic times, but of the larger number we can only say that they are Pre-Roman.

From these deposits forty-six species have been obtained and of these five have not been found living, viz. :—

Vertigo moulinsiana (Dup.)

Truncatellina cylindrica (Fér.)

„ *britannica* (Pils.)

Vallonia pulchella (Müll.)

Trochulus libertus (West.)

It is probable that further research may add these species to the recent list. Doubt has been expressed as to the validity of the specific rank of *Trochulus libertus* (West.) but in a fossil state it can easily be separated from *T. hispidus* (Linn.) by its marked preservation of colour.

There are only five localities in Kent which have yielded mollusca of Roman age, Borstal, Darenth, East Wear Bay, Ightham and Otford, whilst I obtained a few specimens from a Roman building at Northfleet. I think the importance of the Roman occupation of England in altering the distribution of the mollusca has been overlooked. Previous to the Roman invasion man had effected but little change in the face of the country. It is true that a small part was under cultivation but in the main no change had been made. The rivers and streams were not bridged, mills were unknown, the swamps undrained and it is clear, from classical writers, that the woodland was extensive.

But during the four hundred years of Roman rule England became a civilized country, not only sustaining a large population but able to export large quantities of corn. It has been stated that the population of Roman England was not again attained until the reign of Queen Elizabeth. Besides the towns numerous agricultural villages were scattered over many districts and a very large area must have been under cultivation. In many cases the Roman tilth has been untouched by the plough since then. This cultivation must have affected the mollusca, whilst the extensive commerce with the continent would furnish facilities for the introduction of alien species. From the Roman deposits I have listed thirty-four species and of these three are not found in pre-Roman deposits, viz. :—

Azeca goodalli (Fér.)

Helicella rogersi (B. B. Woodw.)

Helix aspersa Müll.

The post-Roman deposits are of no great importance and are usually of mediæval age. They have yielded thirty-three species, only one being unknown in earlier beds, viz. :—

Theba cantiana (Mont.)

Having thus given an outline of the evidence I will now examine in detail some of the problems which arise. It will at once be noted that sixteen species are unknown in a fossil state. Three species must be considered as accidental introductions :—

Cochlostoma septemspirale (Raz.)

„ *patulum* (Drap.)

Trochulus umbrosus (Partschi)

The colony of the last has apparently died out whilst its past and present distribution negatives the view that it is indigenous. The two species of *Cochlostoma* were found together on an old wall at Kearsney, but how they got there is a mystery. Of these three species only a few examples were found. *Xeroclivia elegans* (Gmel.) has a wider distribution than was originally believed and though the original locality is now buried beneath the tip from a neighbouring colliery it has been found over a mile away as I am informed by H. C. Huggins. It is clear that the colony is of long standing but its continental distribution is against its claim to be an integral part of the fauna. For the same reason I would reject *Xerophila neglecta* (Drap.) though the problem as to how the colony originated is very puzzling. *Abida secale* (Drap.) is widely distributed in East Kent and has been found in several Pleistocene deposits. Unfortunately no Holocene deposit has been worked in the district in which it now lives so that its absence is probably due to the imperfection of the geological record. *Zenobiella subrufescens* (Mill.) has never been found fossil and from the nature of its shell is never likely to be, but there is no valid reason to doubt its claim to inclusion in the list. *Zonitoides excavatus* (Ald.) is only known from the inner Weald and no deposits are known in that district but it must be included as a true native.

Pyramidula rupestris (Drap.) is extremely rare in Kent and is a very rare fossil in these islands. Its true position is uncertain but I would point out that Kent untouched by man would have few, if any, suitable habitats for the species. *Acanthinula lamellata* (Jeff.) is only known from one locality but is probably truly indigenous. This species is unknown living from Essex but is a common fossil whereas in Kent it is known living but not fossil. Future research may, I hope, solve these problems. *Eulota fruticum* (Müll.) is widely distributed but its area of distribution has yielded little fossil evidence. I do not think that it is a modern introduction and include it in the list. The absence of *Ashfordia granulata* (Ald.), a rare living species, probably arises from lack of evidence for it occurs in the Pleistocene. *Clausilia dubia* (Drap.) is only known from Dover Castle and, I suggest, has been introduced with building material from France. *Laciniaria biplicata* (Mont.) is unlikely to be an introduction, living as it does in Essex and Surrey. As a fossil it is extremely rare in England and I consider it a native species. *Cernuella virgata* (Da Cost.) and *Candidula caperata* (Mont.) are very abundant to-day in Kent especially on the slopes of the downs. Both species appear fossil in the Holocene of the West of England, but the evidence is conclusive that in Kent they are quite recent immigrants.

As already noted there are three species that are unknown before the Roman period, viz. :—

Azeca goodalli (Fér.)

Helicella rogersi (B. B. Woodw.)

Helix aspersa (Müll.)

Of these the first two I consider indigenous. They are known from the Pleistocene and their geological history in other parts of England supports this view. *Helix aspersa*, however, is on a different footing. In the south-west of England it is known from early Holocene beds and from the Pleistocene, but over the rest of England it is quite unknown in pre-Roman times, though it is usually very common in association with Roman buildings and there can be no doubt that the Roman period witnessed a great extension of its range. Originally a native of a warm climate it does not burrow for its winter sleep but hides in crevices and it was the great extension of buildings that provided its requirements. It was interesting to see, as I did once, the shells in the crevices of the Roman Wall of London still attached to the stone, and probably killed by a severe winter fifteen hundred years ago. As to the species that are absent from the Roman deposits though present in the earlier beds I think we can assume that they still lived in Kent.

Only one species makes its first appearance in the post-Roman beds, *Theba cantiana* (Mont.). This may have been introduced in Norman times or even later; this late date for its introduction is supported by all the available evidence.

One can thus say there are fifty-five species of land mollusca indigenous to the county, viz. :—

Pomatias elegans (Müll.)

Acme lineata (Drap.)

Carychium minimum (Müll.)

Abida secale (Drap.)

Lauria cylindracea (Da Cost.)

Pupilla muscorum (Linn.)

Vertigo pusilla (Müll.)

„ *antivertigo* (Drap.)

„ *substriata* (Jeff.)

„ *pygmæa* (Drap.)

„ *moulinsiana* (Drap.)

Columella edentula (Drap.)

Truncatellina cylindrica (Fér.)

„ *britannica* Pilsb.

Acanthinula aculeata (Müll.)

„ *lamellata* (Jeff.)

- Vallonia pulchella* (Müll.)
 „ *excentrica* Sterki.
 „ *costata* (Müll.)
Cochlicopa lubrica (Müll.)
Azeca goodalli (Fér.)
Ena obscura (Müll.)
Punctum pygmæum (Drap.)
Goniodiscus rotundatus (Müll.)
Petasina fulva (Müll.)
Zonitoides nitidus (Müll.)
 „ *excavatus* (Ald.)
Helicella cellaria (Müll.)
 „ *rogersi* (B. B. Woodw.)
 „ *alliaria* (Mill.)
 „ *nitidula* (Drap.)
 „ *pura* (Ald.)
 „ *radiatula* (Ald.)
Vitrea crystallina (Müll.)
Vitrina pellucida (Müll.)
Eulota fruticum (Müll.)
Xerophila itala (Linn.)
Candidula gigaxii (Pfr.)
Theba cartusiana (Müll.)
Ashfordia granulata (Ald.)
Zenobiella subrufescens (Mill.)
Trochulus hispidus (Linn.)
 „ *libertus* (West.)
 „ *striolatus* (Pfr.)
Chilotrema lapicida (Linn.)
Arianta arbustorum (Linn.)
Helix pomatia Linn.
Cepæa nemoralis (Linn.)
 „ *hortensis* (Müll.)
Balæa perversa (Linn.)
Laciniaria biplicata (Mont.)
Clausilia rugosa Drap.
 „ *rolphii* Leach.
Marpessa laminata (Mont.)
Ceciloides acicula (Müll.)

One species was introduced in Roman times

Helix aspersa Müll.

One species was certainly added to the fauna during the Norman or Mediæval periods

Theba cantiana (Mont.)

Clausilia dubia Drap. is probably in the same category.

Seven species are modern introductions, viz. :—

Cochlostoma septemspirale (Raz.)

„ *patulum* (Drap.)

Cernuella virgata (Da Costa)

Xerophila neglecta (Drap.)

Candidula caperata (Mont.)

Xeroclivia elegans (Gmel.)

Trochulus umbrosus (Partschi)

and possibly *Pyramidula rupestris* (Drap.)

There is one other species that may be mentioned—*Vertigo angustior* Jeff. A single example of this species was found in material from Ightham but the age is doubtful. It may be either Holocene or Pleistocene, the probability being that it is early Holocene, the period when its area of distribution was at its maximum, but it is better to wait for further evidence. It is possible that two or three species may yet be added to the list. *Lauria anglica* (Fér.), *Goniodiscus ruderatus* (Fér.) and *Vitrina major* (Fér.) are possible members of the Kentish fauna and one may even say probable, so that in this as in so many matters we have not yet attained finality.

CHANGES IN DISTRIBUTION.

One thing that is emphasized by these deposits is that there is no stability in the molluscan fauna. As we have seen it is possible to ascertain the advent of certain species and we can also note the waxing and waning of other forms. With some of the hillwashes it is possible at the present day to collect from the same area as provided the material for the deposit so there is no possibility of error and one can compare the pre-Roman fauna with the existing one and note the differences. Some of these changes arise from the minor fluctuations in climate or rather rainfall that have occurred since Pleistocene times. As is well-known there was a period of heavy rainfall during the Neolithic period. This enabled the damp-loving species to extend their areas of distribution and we find that such species as *Acme lineata* (Drap.), *Vertigo substriata* Jeff., *Helicella radiatula* (Ald.) and *Arianta arbustorum* (Linn.) lived on the slopes of the chalkhills. At the present day not one of these species lives there. Three occur around the springs at the foot of the hills but *Acme lineata* (Drap.) has apparently died out. The conditions must indeed have been very different from those of to-day to enable such species to live there. It is interesting to note that in these pre-Roman beds *Cepæa nemoralis* (Linn.) and *C. hortensis* (Müll.) are

constantly found together. At the present day *C. hortensis* (Müll.) has retreated to the water level whilst *C. nemoralis* (Linn.) still survives, but in sadly depleted numbers, whilst the slopes of the chalk hills are covered with myriads of the newcomers *Cernuella virgata* (Da Costa), *Candidula caperata* (Mont.) and *Theba cantiana* (Mont.).

Now in Norfolk, Sussex and Wiltshire and in Ireland the early Holocene examples of *Cepæa nemoralis* (Linn.) are markedly larger than recent specimens from the same area, but this is not the case in Kent where there is little if any variation between the two series, and it may be mentioned that the fossil examples of *Arianta arbustorum* (Linn.), from Kent, though decidedly larger than living ones do not attain the size of fossil examples from Wiltshire and Sussex from similar localities. I have no explanation of this to offer. The question of size in land mollusca is indeed puzzling. So far as one can see the conditions of the valleys at the Darent and Dour are identical, both as to geological formation and rainfall, yet in the former *A. arbustorum* (Linn.) is normal in size whilst the examples from Temple Ewell in the Dour Valley are extremely large, and many similar cases could be cited. It would appear, however, that the conditions that affect the size of one species may have no effect on another. *Helix aspersa* (Müll.) is apparently influenced by the soil on which it lives. On the chalk areas it attains to a large size, on the gault clay it is decidedly small, whereas on the Greensand it is normal, whilst *Cepæa nemoralis* (Linn.) shows no variation in size.

But all the changes in distribution are not due to the diminution of rainfall. At the present day *Theba cartusiana* (Müll.) does not live further west than Canterbury yet in pre-Roman times it flourished from Otford along the chalkhills as far as Birling and on the left bank of the Medway to Cuxton. It was common round Northfleet and its occurrence at Hollingbourne is a link with its present area of distribution. The cause of this local extinction is indeed puzzling. The rainfall in the area in which it survives is practically identical with that of the district from which it has disappeared but it must be remembered that this species has become extinct in Essex and the two or three isolated colonies in Suffolk are the relics of a wider distribution in the past. It has been suggested that it has been driven out by *Theba cantiana* (Mont.) but *T. cartusiana* (Müll.) had disappeared long before *T. cantiana* (Mont.) appeared on the scene. It is clear that *T. cartusiana* (Müll.) is a waning species. More than that with our present knowledge it is impossible to say. *Helix pomatia* Linn. at the present day has two areas of distribution in Kent, one west of the Medway and the other

east of that river. The former area is practically linked up with a large area in Surrey where the species is common. The East Kent area is much smaller and there are no occurrences linking up the two areas.

There are three records for this species in a fossil state—Darenth, Halling and Northfleet, all outside its present range. Darenth is of Roman age and indicates a slight extension of its present area. Halling is post-Roman and this brings the western area to the Medway. Northfleet is pre-Roman and gives a large extension. It should be noted that this species occurred also at Northfleet in a Roman deposit showing that its extinction is of later date. We thus see that the western area has considerably diminished and though cultivation may have played a little part yet other causes have been at work. So far I have failed to trace this species fossil in East Kent. Sections in the chalk hills east of the Medway are but few and at present geology can throw no light on the Charing enclave. It is interesting to note that this species was large enough to attract the attention of our ancestors and Snag Lane at Cudham and Snag Bank at Shoreham are localities where *Helix pomatia* Linn. still lives. Another species that has lost ground is *Trochulus striolatus* (Pfeiff.) but this is probably due to the decrease of rainfall. It is common at the lower levels but is rarely found on the slopes where it was once common.

There are three species that are more common to-day than formerly. These are *Ena obscura* (Müll.), *Helicella rogersi* (B. B. Woodw.) and *Vitrina pellucida* (Müll.).

They are decidedly rare in a fossil state, especially the two latter and there again I can offer no explanation as to the cause. Thus it is with our science, as our knowledge increases and some of the old problems are satisfactorily explained we find ourselves confronted by fresh ones demanding wider investigation. I have endeavoured to show that much may be learnt from a study of the mollusca of our more recent deposits and I would appeal to the younger members of this society to undertake similar work in other parts of these islands. It is true that as a rule the Holocene deposits are small, but my experience has been that they are much more common than is usually thought. There is an ample field for investigation in many parts, especially in the Midlands where swamp deposits are apparently common. The lake marls of Scotland are practically untouched and only one has been investigated in Wales so it is obvious that the subject is not yet exhausted. Work of this kind has no pecuniary rewards. Its results are not published in large type by the daily press, neither is it broadcast, but it does give an added zest to life and there is no higher ideal than the quest of knowledge for its own sake.

			Recent	Post-Roman	Roman	Pre-Roman	Pleisto-cene
<i>Pomatias elegans</i> (Müll.)	×	×	×	×	×
<i>Acme lineata</i> (Drap.)	×	×	×
<i>Cochlostoma septemspirale</i> (Raz.)	×
„ <i>patulum</i> (Drap.)	×
<i>Carychium minimum</i> Müll.	×	×	×	×	×
<i>Pyramidula rupestris</i> (Drap.)	×
<i>Abida secale</i> (Drap.)	×	×
<i>Lauria cylindracea</i> (Da Costa)	×	×	...
<i>Pupilla muscorum</i> (Linn.)	×	×	×	×	×
<i>Vertigo pusilla</i> (Müll.)	×	×	...
„ <i>antivertigo</i> (Drap.)	×	×	×
„ <i>substriata</i> (Jeff.)	×	×	...
„ <i>pygmæa</i> (Drap.)	×	×	×	×	×
„ <i>moulinsiana</i> (Dupuy)	×	...
<i>Truncatellina cylindrica</i> (Fér.)	×	×
„ <i>britannica</i> Pilsb.	×	×
<i>Columella edentula</i> (Drap.)	×	×	...
<i>Acanthinula aculeata</i> (Müll.)	×	×	×	×	×
„ <i>lamellata</i> (Jeff.)	×
<i>Vallonia pulchella</i> (Müll.)	×	×	×	×
„ <i>excentrica</i> Sterki	×	×	×	×	×
„ <i>costata</i> (Müll.)	×	×	×	×	×
<i>Cochlicopa lubrica</i> (Müll.)	×	×	×	×	×
<i>Azeca goodalli</i> (Fér.)	×	...	×	...	×
<i>Ena obscura</i> (Müll.)	×	×	×	×	×
<i>Punctum pygmæum</i> (Drap.)	×	×	×
<i>Goniodiscus rotundatus</i> (Müll.)	×	×	×	×	×
<i>Petasina fulva</i> (Müll.)	×	×	...	×	×
<i>Zonitoides nitidus</i> (Müll.)	×	×	×	×	×
„ <i>excavatus</i> (Ald.)	×
<i>Helicella cellaria</i> (Müll.)	×	×	×	×	×
„ <i>rogersi</i> (B. B. Woodw.)	×	...	×	...	×
„ <i>alliararia</i> (Mill.)	×	...	×	×	×
„ <i>nitidula</i> (Drap.)	×	×	×	×	×
„ <i>pura</i> (Ald.)	×	×	×	×	×
„ <i>radiatula</i> (Ald.)	×	×	...	×	×
<i>Vitrea crystallina</i> (Müll.)	×	×	×	×	×
<i>Vitrina pellucida</i> (Müll.)	×	×	×	×	×
<i>Eulota fruticum</i> (Müll.)	×
<i>Cernuella virgata</i> (Da Costa)	×
<i>Xerophila itala</i> (Linn.)	×	×	×	×	×
„ <i>neglecta</i> (Drap.)	×
<i>Candidula caperata</i> (Mont.)	×
„ <i>gigaxii</i> (Pfr.)	×	×	×	×	...
<i>Xeroclivia elegans</i> (Gmel.)	×
<i>Theba cartusiana</i> (Müll.)	×	...	×	×	×
„ <i>cantiana</i> (Mont.)	×	×
<i>Ashfordia granulata</i> (Ald.)	×	×
<i>Zenobiella subrufescens</i> (Mill.)	×
<i>Trochulus hispidus</i> (Linn.)	×	×	×	×	×

<i>Trochulus libertus</i> (West.)	...	...	...	...	...	×	×
„ <i>striolatus</i> (Pfr.)	...	...	×	×	×	×	×
„ <i>umbrosus</i> (Part.)	...	...	×	...	...	...	...
<i>Chilotrema lapicida</i> (Linn.)	...	...	×	×	×	×	×
<i>Arianta arbustorum</i> (Linn.)	...	...	×	×	×	×	×
<i>Helix pomatia</i> Linn.	...	...	×	×	×	×	...
„ <i>aspersa</i> Linn.	...	...	×	×	×	...	...
<i>Cepæa nemoralis</i> (Linn.)	...	...	×	×	×	×	×
„ <i>hortensis</i> (Müll.)	...	...	×	×	×	×	×
<i>Balæa perversa</i> (Linn.)	...	...	×	...	...	×	...
<i>Laciniaria biplicata</i> (Mont.)	...	...	×	...	...	...	...
<i>Clausilia rugosa</i> Drap.	...	...	×	×	×	×	×
„ <i>dubia</i> Drap.	...	...	×	...	...	...	...
„ <i>rolphii</i> Gray	...	...	×	...	...	×	...
<i>Marpessa laminata</i> (Mont.)	...	...	×	×	×	×	×
<i>Ceciloides acicula</i> (Müll.)	...	...	×	×	×	×	×
TOTALS			61	33	34	46	41

Cephalopoda, etc. at Scarborough in 1928.—On February 1st a specimen of *Sthenoteuthis caroli*, Furt. about 4 feet in length was cast up in the S. Bay and identified at the British Museum. Only the fourth specimen known to science, this was the second for our district. *Ommastrephes sagittatus* (Lk.) has turned up frequently throughout the year, the largest specimen measuring 3' 8" in total length. This species is new to our local list. *Eledone moschites* (Lk.) was taken on April 4th. *Todaropsis eblanæ*, Ball, apparently only the second for the North Sea, was taken off Robin Hood's Bay. *Rossia macrosoma* (Chiaje) ♀, a specimen described by the British Museum experts as the largest ever taken, was caught seven miles off Whitby. *Sepiola scandica*, Steenstrup. Several specimens taken by shrimpers in both Scarborough and Filey Bays. Of *Loligo forbesi* Steenstrup, several egg clusters have been found on Filey Sands, one of which contained no less than 79 capsules. Other interesting locally taken marine mollusca include *Lyonsia norvegica*, taken by Mr. Stevenson eight miles off Hayburn Wyke and *Eulima intermedia*, a new local record, taken by the same collector.—W. GYNGELL.

***Helix hortensis* (Müll.) Monstrosities at Scarborough**—Hunting through the Bean collection in the Scarborough Museum I have been pleased to find a sinistral specimen about half-grown, and an adult example of the same species with sunken spire, much resembling a *Planorbis corneus* in form and quite unlike any *Helix* monstrosity that I have seen.—W. GYNGELL.

NOTES ON SOME VARIETIES OF *CYPRÆA TIGRIS* Linné,
AND *CYPRÆA VINOSA* Gmelin.

BY HUGH C. FULTON.

(Read before the Society, November 7th, 1928).

IN the "Memoirs and Proceedings, Manchester Literary and Philosophical Society," 4th ser., Vol. I, 1888, Dr. Melvill described some varieties of *Cypræa tigris* and *vinosa* (= *pantherina* Auct.).

As this work is not very accessible to many conchologists I have quoted here the original descriptions and have added notes and measurements of the type specimens which are now (except one) in the collection of J. R. le B. Tomlin of St. Leonards-on-Sea, who kindly allowed me to inspect and compare them with specimens in my own possession.

***Cypræa vinosa* var. *badionitens* Melvill.**

Type. Long. 57. Diam. 36 mm.

"*Badionitens* (var. nov.). Shell smaller than the type, somewhat transparent, dorsal surface partly suffused with light golden brown, spots well nigh obsolete. A rare and striking variety."—Melvill.

***Cypræa vinosa* var. *juvenca* Melvill.**

Type. Long. 64. Diam. 38 mm.

"*Juvenca* (var. nov.). Very pale fawn colour, spots almost obsolete, owing to the enamel being laid on more thickly than is ordinary. This variety, which usually has some tendency to distortion, often resembles *C. umbilicata* (Sowb.), the base, however, will at once show its specific affinity."—Melvill.

NOTE.—The var. *badionitens* is of a rather light golden-brown ground colour with irregular darker dorsal patches of the same colour.

The var. *juvenca* has the same ground colour but much lighter and has not the dark patches. These two varieties make one good variety distinguishable by their colouration. There is a good coloured fig. of this variety in the "Conch. Cab." monograph of *Cypræa*, pl. 27, fig. 6, a specimen that is intermediate between the two vars. of Dr. Melvill.

***Cypræa vinosa* var. *theriaca* Melvill.**

Type. Long. 74. Diam. 44 mm.

"*Theriaca* (var. nov.). Shell entirely, with the exception of the extremities and base, suffused with rich golden red-brown, not disposed in blotches as in *badionitens*. Figured in Sowerby, Thes. Conch. pl. xi., fig. 71. Some specimens are almost, if not quite, black, and a monstrous form also occurs pretty frequently with warty extraneous growth, principally at one or other extremity (*theriaca distorta*)."—Melvill.

NOTE.—This is *C. obtusa* Perry. Perry's Conch. pl. xix, fig. 1, which name has priority over *theriaca*.

Perry's figure is almost identical with the type of Melvill's *theriaca* and represents the intermediate colouration of this variety, which varies from a very light golden-brown to specimens that are almost black. Figured in Conch. Cab. pl. 27, fig. 3; Thes. Conch. pl. xi, fig. 1.

***Cypræa vinosa* var. *syringa* Melvill.**

Type. Long. 75. Diam. 43 mm.

"*Syringa* (var. nov.). Shell with pale lilac tinge. Spots dark purple."—Melvill.

NOTE.—This is a typical *vinosa* except for its pale violet or lilac ground tint. Figured in Conch. Cab. pl. 27, fig. 1.

Specimens occur with all kinds of markings on this more or less pale violet-tinted ground colour.

***Cypræa vinosa* var. *albonitens* Melvill.**

Type. Long. 63. Diam. 38 mm.

"*Albonitens* (var. nov.). Spots smaller and more distant, giving therefore greater prominence to white body colour of the shell."—Melvill.

NOTE.—This variety ranges from specimens all cream-white, except for spots at the sides, to specimens with the same ground colour but closely covered with dark spots. The type is intermediate.

Figured in Conch. Cab. pl. 25, figs. 1 and 3.

***Cypræa tigris* var. *flavonitens* Melvill.**

Type, location unknown. This scarce var. was founded on Sowerby's figure in his Thesaurus, pl. xxi, fig. 175.

"*Flavonitens* (var. nov.). (Sowb. Thes. C., pl. xxi, fig. 175). Suffused with rich yellow or orange. Spots often more sparsely distributed. A very beautiful and well known form from Mauritius chiefly, also from the Fiji Islands."—Melvill.

NOTE.—I have a specimen similar to type, it has a ground colour of dark golden-brown. Dr. Melvill evidently intended to include the lighter orange coloured var. that has since been named var. *rossiteri* by Dautzenberg, in the Jour. de Conchyl., vol. 50, 1903, p. 342. A good figure of var. *rossiteri* is given in the Conch. Cab. pl. 30, fig. 1.

***Cypræa tigris* var. *hinnulea* Melvill.**

Type. Long. 80. Diam. 59 mm.

"*Hinnulea* (var. nov.). Pale grey-brown coloured, spots almost obsolete. Of very infrequent occurrence, compared with the last variety, corresponding to *C. pantherina* var. *juvenca*."—Melvill.

NOTE.—Ground colour is very pale grey-brown, almost cream with distinct spots of a darker shade. It is similar to var. *rossiteri* but without the orange colour and the spots at sides are paler.

Cypræa tigris var. **russonitens** Melvill.

Type. Long. 105. Diam. 70 mm.

"*Russonitens* (var. nov.). Dorsal surface suffused with blackish grey, partly obscuring the spots; dorsal line an irregular, broad blood coloured stain running longitudinally. A rare and striking variety. I have two, formerly in Mr. Lombe Taylor's collection."—Melvill.

NOTE.—This is the very dark variety, the dark spots being very numerous in the type, almost covering the dorsal surface.

This is probably the var. *nigrescens* Gray, Zool. Journ., 1824, p. 367, but location of type was Mus. Edwards. There is no shell so marked in the British Museum.

Cypræa tigris var. **chionia** Melvill.

Type. Long. 79. Diam. 56 mm.

"*Chionia* (var. nov.). Spots fewer in number; dorsal surface therefore whiter in appearance. This runs into *flavonitens* frequently, and corresponds to *C. pantherina* var. *albonitens*."—Melvill.

NOTE.—The well-known whitish ground coloured var. with dark spots.

Cypræa tigris var. **ionthodes** Melvill.

Type. Long. 82. Diam. 63 mm.

"*Ionthodes* (var. nov.). Dorsal surface with large, often triangular, black blotches, thus partly obscuring the ordinary markings. This variety is not very frequent."—Melvill.

NOTE.—The type is a typical *tigris* with large jet-black patches.

Cypræa tigris var. **lyncichroa** Melvill.

Type. Long. 80. Diam. 58 mm.

"*Lyncichroa* (var. nov.). Spotted and coloured with blue and fawn, in pattern resembling *C. lynx* (L.), dorsal sinus reddish, very distinct; shell usually rather stunted, and smaller than the other forms, sides and base white."—Melvill.

NOTE.—This is simply a small heavy broad shell with markings having some slight resemblance to *C. lynx*. The type has a small patch of pale golden-brown colour on its dorsum, a character that occurs occasionally in many varieties of the species.

Cypræa tigris var. **zymecrasta** Melvill.

Type, location unknown.

"*Zymecrasta* (var. nov.). Dorsal spots obsolete, the surface entirely suffused with mixed blue, red and brown wash, probably owing to the

enormous extension of the sinus, from some defect in the mantle of the animal. I have seen a few specimens of this colour variety, and the effect is most striking. Sides as in the type, spotted, base white, normal."—Melvill.

NOTE.—In 1912, having a specimen of typical *tigris*, but with a broad band (about 20 mm. wide) on its dorsum and coloured according to original description, I sent it to Dr. Melvill for comparison with the type specimen and he replied, "I think the *tigris* enclosed is a var. approaching *zymecrasta* but not fully it by any means. I have seen no specimen but the type (where it is I do not know) which was a wonderful blending of grey, purple, ochre and warm brown all over the dorsal surface to the sides. I have never seen it since." I suggest that this was a specimen that had not finished its final colouration. I have had two specimens of the colouration described but they had about 15 transverse bands over the dorsum and although they appeared adult I believe they had not their final ornamentation, sometimes one sees unfinished specimens with zig-zag markings. I think we may list *zymecrasta* as what Hidalgo would term a "Testa incompleta."

***Cypræa tigris* var. *nephelodes* Lancaster.**

Type. Long. 102. Diam. 66 mm.

Journ. of Conch., vol. xviii, 1928, p. 247.

NOTE.—This is a striking variety bearing some resemblance to a giant *C. lynx*.

It is somewhat difficult to fix typical *tigris* from the more or less poor figures referred to by Linné, but the following appear to represent it :—

Reeve, Conch. Icon., *Cypræa* fig. 12b.

Sowerby, Conch. Illust., fig. 90.

Hidalgo in his monograph (1906-7) notes altogether 17 varieties of *tigris*.

Among the specimens of *tigris* brought together by the late J. M. Williams of Liverpool, certainly the finest series by far that I have ever seen, are many varieties quite as worthy or unworthy of names as those already described.



The NOMENCLATURE OF CERTAIN BRITISH MOLLUSCA, II.

By J. DAVY DEAN, F.E.S.

Of the Department of Zoology, National Museum of Wales.

(Read before the Society, Dec. 7th, 1927).

PLATE VIII.

CLASS GASTROPODA.

Family APORRHAIIDÆ.

Genus *Aporrhais* Da Costa, 1778.

Aporrhais was defined by Da Costa¹ as '*subfuscus, anfractibus nodosis, labro palmato quadrifido.*' The only species cited is '*quadrifidus*. Tab. 7, fig. 7.' This is our well-known *pes-pelecani*, which name is quoted in synonymy. As the only species this becomes type by monotypy.

Chenopus was defined by Philippi in 1836.² Two species are cited, one, *pes pelecani* under 'species vivæ,' and *pes pelecani* and *pes graculi*, fossil. In 1844 *pes pelecani* and *serresianus* appear under 'Species vivæ' and *pes graculi* Bronn and *desciscens* n.sp. under 'Species fossiles.' *C. serresianus* and *desciscens* are figured, the similarity of the latter to *macandreae* Jeffreys being remarkable, and, as Jeffreys himself says,³ differing only in the presence in *desciscens* of an extra row of tubercles on the body-whorl. Philippi says (in 1844) 'Pro hoc meo genere Dillwyn ex mera hypothese et quidem falsa anno 1823 nomen *Aporrhais* proposuit, sed characteribus nullis ab affinibus distinxit.' This refers to "Lister Hist. Syn. meth. Conch. Ed. 3" by L. W. Dillwyn. In the "Handbuch der Conch. und Malac.," published in 1853, Philippi recognises and correctly uses *Aporrhais* Da Costa, in place of his *Chenopus*.

Aporrhais pes-pelecani (Linnæus).*Strombus Pes pelecani*, Linnæus, 1758.*Aporrhais quadrifidus* Da Costa, 1778.*Rostellaria pes-pelecani* Lamarck, 1822.*Chenopus Pes pelecani* Philippi, 1836.*Aporrhais pes pelecani* Philippi, 1853.

This species ranges from Iceland to the Mediterranean and the shell varies considerably. The Linnæan type appears to be the Mediterranean form and is referred to by Hanley,⁴ thus 'The *Aporrhais pes-pelecani* (Crouch Introd. Lam. Conch. pl. 18, fig. 3) is

1. "Historia Naturalis Testaceorum Britanniae," p. 136.

2. "Enumeratio Molluscorum Siciliæ," vol. i, p. 214, 1836; ii, p. 184, 1844.

3. "British Conchology," vol. iv, p. 254.

4. "Ipsa Linnæi Conchylia," p. 266.

preserved in the box marked for this species in the Linnæan cabinet. and alone agrees with the definition of the shell.' It is rather difficult to follow the meaning of the word 'alone' but the direct reference to Crouch's figure suggests that the Mediterranean form is the Linnæan type. Kobelt⁵ takes this view as do also Bucquoy, Dautzenberg and Dollfus.⁶ Mr. Tomlin tells me the Linnæan cabinet is rich in Mediterranean shells. Figures 5 and 6 of the accompanying plate come quite close to Crouch's figure. This type is very different from our usual British shells but there is a still greater development in the angular processes: this form is figured by Kobelt (op. cit.); it is the var. *longispinosus* Norman (nomen nudum).⁷

var. **bilobatus** Clément, 1875.

At the other extreme are our Northern shells in which the two outer processes, opposite the aperture of the shell, are strengthened by a more solid layer of shell and, in some, the space between these processes becomes entirely filled in (figs. 1-4). In the National Museum of Wales' collections the most characteristic come from the Pembroke-shire coast, the Dogger Bank, and from Scottish localities. These last are very uniform in type. Those from St. Brides Bay, Pemb. show a tendency to vary (figs. 3 and 4). Shells from the Dogger Bank are solid, with a small wing, probably worn, but in form as fig. 2. Others from Southport, Teignmouth and Dublin (Chaster coll.) vary more individually, and approach the wider wing and open processes of the Southern form.

While, however, this individual variation may become extreme (and Mr. J. W. Jackson tells me he has examples agreeing with my figures 5 and 6 from Southport as well as Irish and Scottish localities) it is very noticeable, in any examination of a good series of the shells, that there is a strong racial likeness, collectively. We should recognise as characteristically British this thick-lipped var, *bilobatus* just as we do the var. *macandreae* Jeffreys of *Aporrhais serresianus* Michaud, for the two cases are parallel. It is rather significant that all the British specimens in the National Museum at Cardiff belong to the var. *bilobatus*. Collectors generally select the best specimens and, as the Mediterranean type is by far the finer in appearance, any such finer specimens would be sure to have been retained. Chaster's Southport series obviously represents the best he obtained. My argument carries my mind back to very early days when I compared Sowerby's figure⁸ with the shells I was able to find at Southport (quite one of

5. "Icon. europ. Meeresconch.," vol. iv. p. 14.

6. "Moll. Mar. Roussillon," vol. i, p. 219.

7. "Mus. Normanianum" iv, 1888, p. 13; also Kobelt (op. cit.), Pl. 102, figs. 1 and 2.

8. "Illustrated Index of British Shells," Pl. 15, fig. 4.

the best localities) and which compared badly—to my own disgust, at that time. The reason is that very probably Sowerby had the Linnæan type before him. Pennant, Woodward (“Manual of the Mollusca”), Forbes and Hanley and other English authors illustrate a British shell and both Pennant and Woodward depict very accurately the var. *bilobatus*.

A reference to Pennant, quoted above,⁹ reveals a curious mistake in the use of the name ‘Pelican’s Foot’ for this species. The old Linnæan name for the Corvorant, or Cormorant as we now call it, was *Pelecanus carbo* from which our *pes pelecani*. It will be seen at once that the resemblance of the shell to the spread-out foot of a Cormorant is much greater than to that of a Pelican. This Linnæan meaning should not be lost sight of. Pennant calls it the ‘Corvorant’s foot,’ as does also Da Costa in quoting him.

9. “British Zoology,” vol. iv, p. 122, 1777.

EXPLANATION OF PLATE VIII.

Aporrhais pes-pelecani var. *bilobatus* Clément.

Fig. 1. Southport.

Fig. 2. Cumbrae (Chaster coll.).

Figs. 3, 4. St. Bride’s Bay, Pemb. (Span coll.).

Aporrhais pes-pelecani Linnæus.

Figs. 5, 6. Adriatic (Wotton coll.).

The above specimens are all from the Zoological Department, National Museum of Wales, and the photographs were kindly taken by Mr. W. E. Howarth, F.G.S., Geological Department, National Museum of Wales.

***Pisidium lilljeborgii* in N.E. Yorkshire.**—Under the guidance of Mr. B. R. Lucas I paid a visit last August to Gormire, the little lake that lies on the oolitic limestone at 500 feet, under the escarpment of the Hambleton Hills four miles east of Thirsk. *Pisidium lilljeborgii* was found some years ago in Malham Tarn, a lake at 1250 feet in the carboniferous limestone of the West Riding and hitherto the only known Yorkshire locality for it, but I have long suspected that it would be found in Gormire too, and the event proved that such is indeed the case. We collected a good many specimens in calcareous mud in which *Littorella* and *Myriophyllum* were growing, where it was associated with *P. nitidum* and *P. hibernicum*. Mr. Lucas on a previous visit collected *P. casertanum*, *milium* and *nitidum* in black vegetable mud at the roots of *Menyanthes*. Other molluscs living in Gormire are *Planorbis albus*, *Valvata piscinalis* and *Sphærium corneum*.—CHAS. OLDHAM (*Read before the Society*, Jan. 2nd, 1929).

NOTE ON THE FAUNA OF THE "HANGING" WOOD ABOVE CREECH GRANGE, DORSET.

BY E. ST. JOHN BURTON, F.L.S.

(Read before the Society, March 7th, 1928).

CREECH GRANGE is situated about 4 miles south of Wareham. The intervening tract of low undulating country, known as Middlebeere Heath, on the east, and Grange Heath, on the west, is covered for the most part by barren heathlands, or boggy ground.

A gradual rise become more abrupt as the Tertiary beds of the district approach the Chalk ridge of the Purbeck Hills, which attain 655 ft. at the highest point, Nine Barrow Down.

The lower portion of the wood above Creech Grange lies just across the margin of the Tertiary clayey strata of the Reading Beds, and on Upper Chalk dipping north at 55 deg. The slope is thus generally very steep, except at one or two places in the hill-side.

A particular spot occupies a kind of recess above the road-way known locally as Creech Hill, and faces north. Protection is here afforded from the prevalent S.W. winds, blowing in from the Channel.

The majority of mollusca collected by the writer in 1903 was found to be confined to this comparatively level patch of ground, covering an area of only 60 by 30 feet. The primary object of searching this wood was to ascertain whether *Ena montana* and *Helicodonta obvoluta* might be associated here, but a careful search failed to reveal them, although conducted in rainy weather. *Clausilia rolpheii* was found in considerable abundance, amongst dead leaves under Beech trees, with *Claus. rugosa* and *Marpessa laminata*. The abundance of *Claus. rolpheii* was very striking, 150 specimens being collected in a few hours, without apparently causing serious depletion.

No specimens were, however, found below the bank on the right of the ascending roadway, owing probably to the steepness of the slope at this point, but a few were on the bank itself. The list of species given does not pretend to be complete, yet will serve to show the possibilities of similarly situated woods in Dorsetshire. It is not suggested that *Ena montana* or *Helicodonta* may occur at Creech. The probability is that *Ena montana* may yet be found living in the more extensive woods around Kingston and East Lulworth.

LIST OF SPECIES.

Vitrina pellucida. Abundant amongst moss and dead leaves.

Oxychilus cellarius. Common.

O. alliarius. In moss, on slightly higher ground.

Retinella pura. Abundant on moss and dead leaves.

R. radiatula. Less abundant than *R. pura*.

Retinella nitidula var. **nitens.** Fairly common.

R. nitidula var. **helmii.** This beautiful variety occurred on the steep slope below the roadway, which cuts obliquely across the clays, &c., of the Reading Beds, and across the adjacent Upper Chalk. Three specimens of var. *helmii* were taken, but none above the road.

Vitrea crystallina. Less common on high ground in this neighbourhood.

Acanthinula aculeata. On dead leaves after rain.

Vallonia pulchella.

Goniodiscus rotundatus. Principally var. *rufula*. (Moq).

Hygromia hispida.

H. striolata. Well represented by large and clean shells.

Helix aspersa.

Arianta arbustorum.

Cepæa nemoralis. The specimens do not call for special remark.

C. hortensis.

Helicigona lapicida.

Carychium minimum.

Cochlicopa lubrica.

Ena obscura.

E. obscura var. **albina.** Rare. This also was only found below the road.

Clausilia rugosa.

Claus. rolphii. Plentiful, amongst dead leaves. Several taken on Beech trunks with *Marpessa laminata*.

Marpessa laminata.

M. laminata var. **albina.** Not abundant.

(Note.—var. *albina* and var. *pellucida*, occur plentifully in a hedge-row between Creech and East Lulworth, with *Hygromia striolata*, var. *alba*, and *Goniodiscus rotundatus*, var. *alba*, rare).



PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND.

567th (Annual) Meeting, held in the Zoological Department, University College, Gower Street, London, W.C., October 20th, 1928.

The President, Mr. A. S. Kennard, in the chair.

Amongst those present were the following :—Messrs. J. W. Jackson, A. E. Salisbury, J. R. le B. Tomlin, G. L. Wilkins, H. H. Bloomer, C. Oldham, R. Garnett, J. C. Dacie, A. K. Lawson, H. W. Worsfold, H. R. Wakefield, J. D. Dean, H. C. Fulton, J. E. Cooper, R. Winckworth, L. C. Hann, A. Gardiner, A. Blok, A. E. Ellis, J. W. Vaughan, Drs. A. E. Boycott, C. Price-Jones, E. W. Bowell, W. T. Elliott, Professor D. M. S. Watson, Capt. C. Diver, Lieut.-Col. A. J. Peile, Miss K. M. White, Miss J. D. Robertson, and Mrs. E. M. Morehouse.

Appointment of Scrutineers.

Messrs. A. K. Lawson and H. W. Worsfold were appointed Scrutineers.

Appointment of Auditors.

Messrs. C. H. Moore and F. Taylor were appointed Auditors.

New Member Elected.

Mrs. Ida S. Oldroyd.

Candidates proposed for Membership.

William Frederick Lloyd James, Sunnyside, Hoarwithy, Herefordshire (introduced by Dr. A. E. Boycott and J. W. Jackson). Trygve Taraldsen, Voll i Egge, Steinkjer, N. Norway (introduced by H. Schlesch and Dr. W. T. Elliott). Frederick George Wagner, 12, Trelawny Road, St. Austell, Cornwall (introduced by C. P. Richards and J. W. Jackson). George Marshall Findlay, M.D., D.Sc., 8, Queen Square, London, W. C. 1 (introduced by Drs. A. E. Boycott and C. Price-Jones).

Member Deceased.

Dr. F. E. Atkinson.

Members Struck Off.

Five members were Struck Off the Roll in accordance with Rule IV.

Presidential Address.

The President delivered an address on "The Land Mollusca of Kent," and a cordial vote of thanks to him was passed unanimously.

Votes of thanks were also accorded to the Authorities of University College (per Prof. Watson) for the use of rooms for the Annual Meeting, and to the Authorities of the Manchester Museum for the use of rooms for the monthly meetings of the Society.

Election of Officers and Council.

The Officers and Council for 1928-29 were unanimously elected as nominated (see page 273).

Exhibits.

By Mr. J. D. Dean : *Tricolia speciosa* Meg., taken with operculum at Lydstep, Pembrokeshire ; *Clathrus clathratulus* Ad., recorded as one inch long, actually $\frac{1\frac{3}{8}}$ ths ; both from the Bartlett Span collection, Nat. Museum of Wales.

By Mr. J. E. Cooper : *Pseudanodonta minima* Millet, very young specimens, from the Thames at Penton Hook ; *Planorbis acronicus* Fér., Cookham ; *P. lævis* Alder, normal form and three abnormal shells from Aldeburgh ; *Murex scorpio*, *M. rota* and other species of the genus ; a series of Barton Clay Gastropoda from Highcliff, Hants.

By Mr. A. E. Salisbury : Varieties of *C. nemoralis* L., *C. hortensis* Müller and *H. arbustorum* L., from the collection of the late C. E. Wright, including *hortensis* 10005 and var. *minor* 12345.

By Mr. H. H. Bloomer : A fine set of Garidæ from all parts of the world, belonging to the genera *Gari*, *Psammocola* and *Psammobella*.

By Mr. J. C. Dacie : Mollusca collected by himself and his son last August at Lahinch, Kilkee and Kilrush in co. Clare, and at Ballybunion and Listowel, co. Kerry.

By Dr. A. E. Boycott : Feeding tracks of *Limax arborum* on stone, alt. 1500', Lingmoor Fell, *Vertigo edentula* from Elterwater, Westmorland, the largest 3.2 mm. long.

By Messrs. Boycott, Diver, Turner and Garstang : *Limnæa peregra*—pigmented, albino, flat and half-flat.

By Dr. C. Price-Jones : *Euparypha pisana* Müller from Hout Bay, Cape of Good Hope and *Limnæa natalensis* Krs. from Kenya Colony.

By Mr. J. W. Jackson : X-Ray photographs of shells from the J. M. Williams collection, Liverpool.

By Mr. H. W. Worsfold : English Pectens, Norwegian Marine Shells ; Small Pelecypods.

By Mr. J. R. le B. Tomlin : *Carychium*—most of the known species ; Triphoridæ from Lifu, Loyalty Isles—about 55 species, some being probably undescribed.

By Mr. A. K. Lawson : Variation in *Limnæa stagnalis* L., collected over a number of years from the same pond at Ashley Mill near Altrincham ; Mollusca destroyed by rabbits and by rats.

By Lt.-Col. A. J. Peile : *Ptychotrema fisheri* Conn. from Ruwenzori ; *Neocyclotus peilei* Gude ; radulæ of *Trivia arctica* (Mont.) and *T. monacha* (da C.) ; also radulæ of *Diplommatina folliculus* Pfr. recently extracted and mounted, from shells collected by Hutton in the Himalayas, probably over 70 years ago.

By Mr. G. L. Wilkins : Series of admirable drawings and of models of living Mollusca ; the British species, which included *Succinea*, *Planorbis*, *Valvata*, *Ancylus* and *Arion* from life ; the foreign marine species—*Conus*, *Harpa*, *Voluta*, *Oliva*, *Mitra* and *Potamides*—after Quoy and Gaimard and others ; also a Chart showing the Orders and Families of the recent Gastropoda, arranged according to the Mollusca volume of the Cambridge Natural History series.

By Mr. C. Oldham : *M. margaritifer* from Shetland and co. Wicklow (series from 20-120 mm. in breadth) ; *Limax tenellus*, living, Berkhamsted ; *V. lilljeborgi*, Lough Inagh, Galway, W. ; *Anodonta anatina*, Wick R., Caithness ; *E. pisana* and var. *diaphana*, Malahide ; *Limnæa glabra* Boscastle ; *A. arbustorum*, Mt. D'Aegla, Engadine, at between 2300 and 2400 metres ; *Planorbis corneus*, two hatched in own aquarium in July, 1922, lived till Aug. 1928, and annually produced many young.

By Mr. A. P. Gardiner, Mr. A. A. M. Gardiner and Miss K. M. White : *Oncidiella celtica* and algæ which it frequents from Trevone, Cornwall ; *Litt. obtusata* with associated algæ, etc. from high water mark at Lee, N. Devon, where fresh water predominates ; *Succinea oblonga* and plant association from Branton Burrows ; Chitons and other mollusca from Oban, Falmouth and Tenby.

ANNUAL REPORT.

THIS is the Fifty-second Annual Report of the Society. Since the last Annual Meeting the Society has lost eight members by death, one by resignation, and six

have been struck off the roll in accordance with Rule IV. Five new members have been elected, including one at this meeting. The membership at present stands at 237.

The losses by death are :—P. E. Radley, C. Upton, Miller Christy, W. H. Hutton, H. C. Burnup, Dr. A. W. Rowe, F. L. Button and Dr. F. E. Atkinson.

Eight monthly meetings have been held at the Manchester Museum, by kind permission of the Museum Committee.

Twenty papers and notes have been read and some have since appeared in the Journal.

The Special Exhibits during the year have been *Ferussaciidæ*, *Aporrhais*, *Lanistes*, *Odontostomus*, Abnormal British Helices, and *Clausilia cravenensis*.

Since the last Annual Meeting three numbers of the Journal have been issued : vol. 18, No. 6, December 1927 ; No. 7, May 1928 ; and No. 8, August 1928, comprising 96 pages of text, 4 plates, and 13 text-figures.

The Library has been added to by books and papers from Messrs. J. Brazier, H. Schlesch, A. E. Ellis, A. S. Kennard, A. E. Salisbury, B. B. Woodward, H. H. Bloomer, R. Gurney, W. E. Alkins, F. F. Laidlaw, F. Baker, G. Dallas Hanna and A. M. Strong ; Miss W. S. S. van Benthem Jutting ; Drs. H. A. Pilsbry and Paul Pelseneer.

Donations to the Cabinet have been received from Messrs. J. Brazier, H. Schlesch and J. R. le B. Tomlin.

RECORDER'S REPORT (Non-Marine Mollusca).

SINCE the last report (vol. xviii p. 182) the following new records, 66 in number, have been authenticated for the Census :—

Cornwall E. (2) :—*Limax cinereoniger* (Boscastle), *Pisidium milium*, *P. parvulum* (= *moitessierianum*), *P. obtusale* (C. Oldham).

Dorset (9) :—*Euconulus fulvus*, *Clausilia rolpheii* (Creech Wood, Wareham : E. St. John Burton).

Isle of Wight (10) :—*Ashfordia granulata*, *Planorbis fontanus*, *Pisidium amnicum* (C. Oldham).

Hants. S. (11) :—*Phytia myosotis*, *Paludestrina ventrosa*, *P. stagnalis* (E. St. John Burton).

Sussex W. (13) :—*Limax tenellus* (Charlton Forest), *Pisidium henslowianum*, *P. pulchellum* (C. Oldham).

Essex S. (18) :—*Amalia sowerbyi*, *Helicella caperata caperata* (A. E. Boycott).

Essex N. (19) :—*Arion subfuscus* (C. Oldham).

Northampton (32) :—*Pisidium nitidum* (C. Oldham).

Gloucester E. (33) :—*Vitrina major* (Charlton Abbots : A. E. Boycott).

Brecon (42) :—*Planorbis corneus* (Llangorse Lake), *Pisidium pulchellum* (C. Oldham).

Lincoln N. (54) :—*Helicella heripensis* (C. S. Carter).

Yorks N. E. (62) :—*Pisidium lilljeborgi* (Gormire : C. Oldham).

Northumberland S. (67) :—*Helix cantiana* (C. Robson).

Isle-of-Man (71) :—*Anodonta anatina* (C. J. Paton).

Edinburgh (83) :—*Pisidium nitidum* (C. Oldham).

Kincardine (91) :—*Hyalinia rogersi*, *Hygromia fusca*, *H. rufescens* (garden), *Punctum pygmaeum*, *Ancylus fluviatilis* (R. Waterston).

Sutherland W. (108):—*Arion minimus*, *Hyalinia radiatula*, *Hy. pura*, *Pisidium casertanum*, *P. hibernicum*, *P. lilljeborgi*, *P. milium*, *P. nitidum*, *P. obtusale*, *P. personatum*, *P. subtruncatum* (C. Oldham).

Caithness (109):—*Anodonta anatina* (R. of Wick : C. Oldham).

Orkney (111):—*Planorbis spirorbis*, *Sphaerium corneum*, *Pisidium hibernicum*, *P. lilljeborgi* (C. Oldham).

Shetland (112):—*Agriolimax lævis*, *Arion hortensis*, *A. minimus*, *Hyalinia radiatula*, *Euconulus fulvus*, *Helicella caperata caperata*, *Carychium minimum*, *Succinea elegans*, *Paludestrina stagnalis*, *Margaritana margaritifera* (Burn of Setter, Walls), *Pisidium henslowanum*, *P. subtruncatum* (C. Oldham).

Clare (141):—*Margaritana margaritifera* (R. Cranny near Ennis : J. Abernethy : see vol. xviii p. 184).

Kerry N. (148 N) *Helicella itala*, *H. caperata caperata*, *Vallonia costata*, *Paludestrina jenkinsi* (J. C. Dacie).

RECORDER'S REPORT (Marine Mollusca).

I regret to report that no member has sent me specimens to report on as Recorder. It is, however, interesting to place on record an addition to our marine list : Dr. J. H. Orton forwarded me live specimens of a gastropod, which is abundant on the oyster beds of Essex : this proved to be the American *Urosalpinx cinerea* (Say) which is now naturalised on the east coast : see Orton and Winckworth, *Nature*, vol. 122, p. 241, August 18, 1928.

From Mr. J. Davy Dean I have had specimens of *Mytilus galloprovincialis* Lam., which is abundant in Cardiff docks.

ANNUAL REPORT OF THE YORKSHIRE BRANCH.

ELEVEN meetings were arranged for the Session, four of which were excursions during the summer months. To the collectors the year has not proved quite as good as last but all the meetings have been well attended. The November and Annual Meetings have yet to take place. We regret to announce the death of two of our members—Mr. W. Harrison Hutton, of Leeds, and Dr. F. E. Atkinson, of Settle.

At the last Annual Meeting held on December 10th, 1927 the following were elected to office :—President, Mr. H. Sowden (York) ; Vice-Presidents, Mr. T. W. Saunders, F.G.S. and Mr. H. C. Versey, M.Sc. ; Hon. Secretary, Mr. John R. Dibb ; Hon. Treasurer and Recorder, Mr. H. J. Armstrong ; Council, Mr. T. Coote (Leeds), Mr. W. Gyngell (Scarborough), Mrs. E. Morehouse (Doncaster), Miss E. Dufty (Doncaster) and past Presidents.

MEETINGS :—The first meeting of the Session was devoted to General Exhibits and was entirely successful, Mr. A. Thorne's exhibition of exotic shells being the outstanding feature. The February meeting took place at Leeds University, and a collection of fossil mollusca was shown and described by Mr. Versey. At the March meeting Mr. H. Sowden delivered the Presidential Address entitled "The Naturalist, The Nature of his Work, and his Reward." There was a good attendance and everyone enjoyed this interesting lecture. Another exhibit meeting was held in April. The four summer excursions to Addingham, York, Doncaster and Bramham were all very successful. In October a collection of shells, which had been presented by Mr. W. Gyngell, of Scarborough, was examined and a most interesting talk upon the collection was contributed by Mr. J. A. Hargreaves. The membership of the Branch is now 48.

JOHN R. DIBB (*Hon. Sec.*).

ANNUAL REPORT OF THE LONDON BRANCH.

THIS Branch is flourishing and 10 monthly meetings were held at which the attendance was good and the Exhibits full of interest, the notes on which were given by our President, Lieut.-Col. A. J. Peile and by Mr. J. E. Cooper.

The London Branch felt highly honoured that its President, Mr. A. S. Kennard had been elected President of the Society for the year under review and the Branch wishes to put on record its high appreciation of the interest and the valuable knowledge which Mr. Kennard has always been ready to give to its members, and which has contributed so largely to the success of the London Branch.

The Branch also wishes to acknowledge its gratitude to Lieut.-Col. Peile, who for so many years has regularly attended meetings and always exhibits most interesting specimens (in many cases collected by himself), for his valuable Notes on the exotic Land Mollusca.

The Branch is again indebted to Mr. J. R. le B. Tomlin and to Major M. Connolly for the loan of valuable exhibits and for literature on the same.

The interest of the meetings has been enhanced by the beautiful coloured drawings and modellings of live mollusca by their member, Mr. Guy L. Wilkins.

Two Saturday Outings were arranged for, but the dry and hot weather on both occasions was unfavourable for snails and slugs.

J. C. DACIE (*Hon. Sec.*).

ANNUAL REPORT OF THE NORTH STAFFORDSHIRE BRANCH.

MR. W. E. ALKINS read an interesting and exhaustive paper at a meeting of the Malacological Society in January last on "The Conchometric Relationship of *Clausilia rugosa* (Drap.) and *Clausilia cravenensis* Taylor." The paper appears in the Proceedings of that Society (Vol. VIII, part ii, August, 1928) and I commend its perusal to our members.

Mr. B. Bryan reports three *Milax gagates* from a garden at Newcastle, Staffs., a new locality for this species in our county; *Agriolimax agrestis* var. *albida* found in company with several type specimens underneath a fallen tree trunk near Longton, Staffs., in September.

Mr. J. Hill records some interesting Mollusca from the Leek district, viz. : a new locality for *Limax cinereoniger*, of which he saw several fine specimens, *V. antivertigo*, in a marsh near Longsdon (also a new locality); *V. substriata*, *Z. nitidus* and *Z. excavatus* (a numerous colony of the last-named species) all near Rudyard Lake. *H. nemoralis* var. *fasciata*, *libellula* and *rubella*, 00000, also a beautiful shell var. *libellula rubella*, the upper whorls bright yellow, and the body whorls red.

Three very depressed shells of *A. arbustorum* were obtained in September at Glutton, Derbyshire.

B. BRYAN (*Hon. Sec.*).

568th Meeting, held at the Manchester Museum, November 7th, 1928.

Mr. G. C. Spence in the chair.

Additions to Library and Cabinet.

"Some Pyramidellidæ from the Gulf of California," by F. Baker, G. Dallas Hanna and A. M. Strong.

"La Variabilité Relative des Sexes d'après des variations chez *Patella*, *Trochus* et *Nassa*," by Paul Pelseneer.

"A list of the Land and Fresh-water Mollusca of the Malay Peninsula with Notes," by F. F. Laidlaw.

"Non-Marine Mollusca of Sumba," by Tera van Benthem Jutting.

Specimens of *Limnæa (Radix) pereger* from Transbaikal; also photographs of shells from H. Schlesch.

New Members Elected.

Trygve Taraldsen, Dr. G. Marshall Findlay, Frederick George Wagner, William F. Lloyd James.

Candidates Proposed for Membership.

Miss Kathleen M. White, Glastonbury, Maidenhead (introduced by A. Gardiner and A. E. Salisbury); Arthur George Wrigley, 60, Pollard's Hill South, Norbury, London, S.W. 16 (introduced by A. S. Kennard and J. W. Jackson).

Resignation.

J. Gordon Dalglish.

Papers Read.

"A new race of Australian Helicidæ," by T. D. A. Cockerell.

"Notes on the named varieties of *Cypræa miliaris*, Gmel., and its relationship to *Cypræa eburnea*, Barnes," by H. C. Fulton.

"Notes on some varieties of *Cypræa tigris*, L., and *Cypræa vinosa*, Gmel.," by H. C. Fulton.

"Description of *Drymæus wintlei* sp. n. from Ecuador," by S. G. Finch.

"*Planorbis lævis* Alder (= *glaber* Jeff.) in E. Suffolk," by J. E. Cooper.

"Marine Mollusca from a Raised Beach in Cornwall," by G. C. Spence.

Exhibits.

By Mr. A. K. Lawson:—*Limnæa stagnalis* with distinct growth-halts, from Ashley Mill, Cheshire.

By Mr. J. Hill:—Photographs of *H. arbustorum* (02000) from Mappleton, Derbyshire; *H. nemoralis* (0(23)00) and distorted form, from Ashcombe Park, Staffs; *H. striolata* m. *scalariforme*, from Consall, Staffs; and *H. hispida* m. *scalariforme*, from Ecton, Staffs.

By Rev. L. W. Grensted:—*H. nemoralis* (curious colour var.) from Burton Bradstock, Dorset; *H. hortensis* v. *arenicola*, 00300, from Maiden Castle, Dorchester; *Clausilia rugosa*, *Marpessa laminata*, *Lauria cylindracea* v. *albina*, *Balea perversa*, *Ena obscura*, *Succinea pfeifferi*, *Planorbis spirorbis* and *Hippeutis fontanus*, all from Burton Bradstock.

The special exhibit was Varieties of *Cypræa tigris* L. and *C. vinosa* Gmel.

569th Meeting, held at the Manchester Museum, December 5th, 1928.

Mr. G. C. Spence in the chair.

Donations to Library and Cabinet.

"Ueber Sibirische Heliciden," by H. Schlesch.

"Nomenclatorial Notes relating to British Non-Marine Mollusca, V.," by A. S. Kennard and B. B. Woodward.

"The Marine Mollusca of the Persian Gulf, Gulf of Oman, and North Arabian Sea.—Addenda, Corrigenda, and Emendanda," by James Cosmo Melvill (by the respective authors).

Limnæa (Radix) pereger, from Transbaikal; various photos; and a series of small *Cypræa* from Aden (coll. Russell), from H. Schlesch.

New Members Elected.

A. G. Wrigley, and Miss Kathleen M. White.

Candidates proposed for Membership.

G. Dallas Hanna, Ph.D., California Academy of Sciences, San Francisco, California, U.S.A. (introduced by H. Schlesch and W. T. Elliott).

Robert Rendall, "Dawnvale," Willow Road, Kirkwall, Orkney (introduced by J. W. Jackson and G. C. Spence).

Members Struck Off.

Two members were struck off the membership roll in accordance with Rule IV.

Paper Read.

"A Cardiff Trawler and *Adula simpsoni* (Marshall)," by J. Davy Dean.

Exhibits.

By Mr. J. W. Jackson (for Mr. R. J. Welch):—Marine shells (mainly *Turritella*) from the Holocene Deposit on the "Shell Bank," Lough Foyle, Co. Derry, Ireland.

By Mr. J. Davy Dean:—Specimens to illustrate his paper.

By Rev. L. W. Grensted:—*Burtoa nilotica* Pfr. and *Achatina* cf. *panthera* Fér. collected by Dr. R. W. Wakefield, between Bulawayo and Salisbury on the Rhodesian Ry.

By Mrs. Gill:—Series of Recent Brachiopoda: also a dead *Neptunea antiqua* L. covered with large barnacles; and fine specimens of *Cypræa caput-serpentis* L.

The Special Exhibit was *Trochozonites*.

570th Meeting, held at the Manchester Museum, January 2nd, 1929.

Mr. G. C. Spence in the chair.

Additions to Library and Cabinet.

"Les Parasites des Mollusques et les Mollusques Parasites," by Paul Pelseneer.

"Copépodes parasites de Mollusques," by P. Pelseneer.

"The Marine Shells of the West Coast of North America," vol. I; vol. II, parts 1, 2 and 3, by Ida Shepard Oldroyd.

"New Fresh-water and Marine Bivalve Shells from Brazil and Uruguay," by W. B. Marshall.

"New Fossil Pearly Fresh-water Mussels from deposits on the Upper Amazon of Peru," by W. B. Marshall (from the respective authors).

Portrait of Dr. M. Rotarides (donor: H. Schlesch).

Election of New Members.

Dr. G. Dallas Hanna. Robert Rendall.

Member Deceased.

Edward J. Elliot.

Papers Read.

"*Pisidium lilljeborgi* in N. E. Yorkshire," by C. Oldham.

"*Agriolimax lævis* (Müll), a woodland slug," by C. Oldham.

Exhibits.

By Mr. A. K. Lawson:—An old book entitled "Beautiful Shells," by H. G. Adams (dated 1855).

By Mr. G. C. Spence:—*Urocoptis* (*Callonia*) *lowei*, Torre, from Guame, Cuba; *Cecina manchurica*, Adams; *Diplommata alata*, Semp., Pelew Is.; *D. mollen-dorffi*, Flt. Celebes; *Rhaphaulus bombycinus*, Pfr., Sarawak; and *Pterocyclos latilabrum*, Sm., Banguay Is.

The Special Exhibit was *Circinaria*.

Accounts for the Year ended December 31st, 1928.

Income and Expenditure Account.

RECEIPTS.			EXPENDITURE.		
	£	s. d.		£	s. d.
To Balance from last Account	4	4 11	By publishing and distributing		
„ Annual Subscriptions			<i>Journal of Conchology</i> , Vol.		
for 1928:			xviii, no. 6	30	16 3
126 at 10/-	63	0 0	,, no. 7	34	11 6
2 at 7/6	0	15 0	,, no. 8	36	11 4
1 at 6/-	0	6 0	(est'd) ,, no. 9	30	0 0
28 at 5/-	7	0 0			
	71	1 0		131	19 1
Arrears ...	9	15 0	„ Authors' Reprints ...	12	16 8
	80	16 0	„ Estimated cost ...	5	0 0
„ Donations towards cost of				149	15 9
Illustrations ...	10	0 0	Less provision made in		
„ Sale of Publications ...	19	10 5	accounts for 1927 ...	35	5 0
„ Advertisements ...	1	7 6		114	10 9
„ Transfer from Life Member-			„ Library Shelves ...	10	15 6
ship Fund ...	10	0 0	„ Warehousing Stock ...	1	10 0
„ Balance, being excess of			„ Fire Insurance ...	0	10 0
expenditure over income	12	12 2	„ Printing and Stationery ...	2	9 3
			„ Officers' Expenses ...	7	4 6
			„ Subscriptions:		
			Malacol. Society	1	1 0
			Zoological Rec.	0	5 0
			Lancs. & Chesh.		
			Fauna Com'tee	0	5 0—1 11 0
	£138	11 0		£138	11 0

Life Membership Fund.

	£	s. d.		£	s. d.
To amount of Fund, Jan. 1st,			By Transfer to Income and		
1928 ...	262	12 3	Expenditure Account	10	0 0
„ One Composition fee at			„ Amount of Fund, Dec.		
£6 6s. od. ...	6	6 0	31st, 1928 ...	271	13 8
„ Dividends and Interest	12	15 5			
	£281	13 8		£281	13 8

BALANCE SHEET.

Liabilities.	£	s. d.	Assets.	£	s. d.
Annual Subscriptions paid in			4% Funding Loan, £308	13	0
advance ...	7	10 0	cost ...	250	0 0
Est. cost of <i>J. of C.</i> , vol. xviii			Balance of Income and Ex-		
no. 9, and Authors' Rep'ts	35	0 0	penditure Account ...	12	12 2
Life Membership Fund ...	271	13 8	Cash at Bankers ...	51	11 6
	£314	3 8		£314	3 8

NOTE.—Assets in addition to those set out in the Balance Sheet are (a) Library; (b) Cabinets and Collections; (c) Stock of unsold Publications; (d) Annual Subscriptions in arrear.

CHAS. OLDHAM,

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THE
JOURNAL OF CONCHOLOGY.

VOL. 18.

JULY, 1929.

No. 11.

ENGLISH AND GERMAN SPECIMENS OF CECILIOIDES
ACICULA (Müll).

BY HUGH WATSON, M.A.

(Read before the Society, May 4th, 1929).

WHEN I laid before this Society the results of my researches on the anatomy and affinities of *Ceciloides* and *Ferussacia*,¹ I was not aware that Dr. Walter Wächtler of Leipzig was then preparing an important monograph on the anatomy of *Ceciloides acicula* (Müll.). This work has now appeared,² together with a shorter article by the same author on the habits of this species,³ and I wish to commend these valuable papers to all who are interested in the subject.

Dr. Wächtler was fortunate in having at his disposal numerous living examples of *Ceciloides acicula*, chiefly collected at Pöhl near Jocketa in Saxony, and he has been able to deal at length with many points which I made no attempt to discuss at all fully. But it is satisfactory to note that as regards almost every important feature of the anatomy Dr. Wächtler's independent observations fully confirm my own.

In a few details, however, this author's descriptions and figures do not entirely accord with mine—notably in the exact form of the penis, the kidney, and the central and lateral teeth of the radula, and in the number of minute cusps on the marginal teeth; in the orientation of the cerebral ganglia and the length of the cerebral commissure; and in the origin of the penial retractor muscle, which Dr. Wächtler agrees with Wiegmann in stating arises from the diaphragm, whereas in the English specimens that I studied I found that it arose as a branch of the broad muscle that passes from the columella to the foot (see plate V, fig. 5 in this volume). One or two of these differences might be due to the organs being in different state of extension or contraction in the specimens examined; but it is clear that some of the differences could not be explained in this way, and, if confirmed, they might suggest that the English and German examples belonged to

¹ "Journ. of Conch.," vol. xviii, 1928, pp. 217-243.

² "Zeitschr. f. Morphol. u. Ökol. d. Tiere," vol. xiii, 1929, pp. 359-462.

³ "Arch. f. Molluskenkunde," vol. lxi, 1929, pp. 1-14.

distinct species, notwithstanding the close resemblance of their shells.

In order that I might investigate this question, Dr. Wächtler very kindly sent me an animal preserved in paraffin-wax and found in the same locality as those that he had studied, together with several empty shells, and two or three of his slides for my inspection. When I dissected the animal I found that the cerebral ganglia were lying obliquely, as shown in his figures and in my drawing of the nervous system of *Ferussacia* (plate IV, fig. 7), and not transversely, as in the English specimens of *Cecilioides acicula* that I examined (plate V, fig. 2). This difference, however, was probably due to the fact that the head was fully extended in the German specimen—instead of being retracted (as shown in my first figure on plate V)—the outer ends of the ganglia having thus been drawn forward with the nerves to the tentacles, etc. On the other hand, I found that in the length of the cerebral commissure, the characters of the radula, and the exact form of the penis and of the kidney, this specimen resembled my figures of English examples more closely than it did Dr. Wächtler's drawings of other German specimens, although the upper part of the kidney was not quite so broad as it is shown in my fig. 7, which depicts a specimen in which I suspect that the upper part of the kidney was slightly wider than usual. Lastly, the penial retractor muscle in this German specimen appeared to arise from the columellar muscle, as in the English snails, and not from the diaphragm. It is conceivable that in *Cecilioides* there may be some variation in the place of origin of this muscle, which probably arose from the diaphragm in the ancestral forms of the family, as it still does in *Ferussacia*; but I lent Dr. Wächtler a preparation of the muscle and its connexions dissected out of the specimen he had sent me, and, after studying it and making a further examination of his own slides, he writes that he now believes that he was mistaken in supposing that the penial retractor arose from the diaphragm in the specimens of *Cecilioides acicula* that he had examined, and that what he mistook for a part of the diaphragm may have been part of the columellar muscle. I may add that anyone who has tried to make out the details of the muscular system in minute snails will understand that it is not difficult to make a mistake of this kind.

Thus, through Dr. Wächtler's kindness, I am able to state that specimens of *Cecilioides acicula* from Saxony agree well in their anatomy with my figures of English examples, and that there is therefore good reason to believe that the British and German specimens are rightly assigned to the same species.

THE MOLLUSCA OF THE 'ST. GEORGE' EXPEDITION.

(II). THE WEST INDIES.

BY J. R. LE B. TOMLIN, M.A.

(Read before the Society, February 6th, 1929).

No. I of this series appeared on pp. 153-170 and 187-198 of the present volume. Only two localities were visited in the West Indian region, viz. :

(1) Port of Spain, Trinidad, where shore collections and dredgings at an unspecified depth were made in June, 1924; and

(2) Colon, where hauls were made in five fathoms and 4 species collected on the breakwater. The occurrence there of *Thais kiosquiformis* alive is of special interest.

CLASS GASTROPODA.

Family MARGINELLIDÆ.

Marginella pulchra Gray.

Zool. Beechey's Voyage, p. 135, pl. xxxvi, f. 20, 1839.

Port of Spain, one dredged living. A rather scarce W. Indian species.

Family THAIDIDÆ.

Thais kiosquiformis (Duclos).

Purpura kiosquiformis Duclos, Ann. Sci. Nat. xxvi, p. 107, pl. i, f. 5, May 1832.

Occurs also as a *nomen nudum* in Nouv. Bull. Sci. Soc. Philom. Paris, livraison d' avril, 1832, p. 56.

Two adult specimens taken alive on Colon breakwater, 11/6/1924 (Hornell). Hitherto only known from the Pacific side of the Isthmus.

It is common at Panama and ranges northwards to Mazatlan.

Family LITTORINIDÆ.

Melarhappe ziczac (Gmelin).

Trochus ziczac Gmelin, Syst. Nat. ed. xiii, p. 3587, 1791.

Port of Spain and Colon breakwater, living, common.

Common throughout the West Indies, and down the South American coast to Brazil.

Family NERITIDÆ.

Nerita tessellata Gmelin.

Syst. Nat. ed. xiii, p. 3685, 1791.

Common living on Colon breakwater.

Family TROCHIDÆ.

Cittarium pica (L.).*Turbo pica* L., Syst. Nat. ed. x, p. 763, 1758.

One on Colon breakwater.

This and the last are well-known Antillean species.

CLASS PELECYPODA.

Family OSTREIDÆ.

Ostrea rhizophoræ Guilding.

Zool. Journ. iii, p. 542, Apr. 1828.

Port of Spain, living on shore. An Antillean species.

Family ARCIDÆ.

Anadara nux (Sow.).*Arca nux* Sowerby, P.Z.S. 1833, p. 19, 17/5/1833.

Port of Spain, dredged living.

I cannot separate these from the type which was dredged at Xipixapi on the other side of the Isthmus.

Fossularca adamsi (Dall.).*Arca adamsi* Dall, Bull. Mus. Comp. Zool. Harvard xii, pp. 191, 243, Sept. 1886.

Port of Spain, dredged living. Locally common in the W. Indies and at Bermuda.

Family NUCULANIDÆ.

Nuculana nasuta (Sow.).*Nucula nasuta* Sowerby, Conch. Illustr. Nucula, p. 4, no. 17, f. 12, 18/1/1833.

Port of Spain, dredged living. These are absolutely identical with the Brit. Mus. examples, and probably they are labelled E. Indies in error.

N. (Adrana) newcombi (Angas).*Leda (Adrana) newcombi* Angas, P.Z.S. 1878, p. 314, pl. xviii, f. 16, 17, Aug. 1878.

Colon Harbour, several dredged alive and dead. This is the type locality.

Family CARDIIDÆ.

Lævicardium serratum (L.).*Cardium serratum* L. Syst. Nat. ed. x, p. 680, 1758.

Port of Spain, dredged alive. A well-known Antillean species.

Lævicardium trinitatis n. sp.

Differs entirely from other species of the American coasts and of the West Indian region by its almost equilateral shape, with umbones noticeably narrowed and prominent; colour pinkish at the umbones, the rest of the shell covered with a light brownish-yellow periostracum,

which is mostly ridged concentrically, finely and rather irregularly ; interior edge of valves finely dentate.

Length 20 mm. ; breadth 19 ; maximum thickness 13.

Hab. Port of Spain, not uncommon, living.

Type. In Brit. Mus.

I am unable to find this among the described species of *Lævicardium*. *L. mortoni* and others are all obviously inequilateral. *L. trinitatis*, as may be surmised from the measurements, is all but circular.

Family VENERIDÆ.

Pitar rostratum (Phil.).

Cytherea rostrata (Koch) Philippi, Abbild. I, p. 150, pl. i, f. 3, July 1844.

Port of Spain, many immature examples dredged alive. The type locality is Brazil.

Family SOLENIDÆ.

Tagelus divisus (Spengler).

Solen divisus Spengler, Skriv. Nat. Selsk. III (2), p. 96, 1794.

Port of Spain, one dredged alive.

Family GARIDÆ.

Asaphis anomala (Born).

Tellina anomala Born, Ind. Rer. Nat. Mus. Caes. Vindob., part I, p. 20, 1778.

Port of Spain, one large example dredged alive.

I adopt this name for the West Indian *Asaphis* on the strength of Mörch's identification in Journ. de. Conch. VII. 140.

Family LUCINIDÆ.

Codakia scabra (Lam.).

Lucina scabra Lamarck, An. sans Vert. V, p. 542, July 1818.

Port of Spain, dead only.

Family TELLINIDÆ.

Tellina lineata Turton.

Conch. Dict. Brit. Is. p. 168, f. 16, 1819.

Port of Spain, dredged living.

Ranges from Florida to Rio Janeiro.

Macoma tenta (Say).

Tellina tenta Say, Amer. Conch. pt. vii, pl. 65, f. 3, 1833.

Port of Spain, young specimens dredged living : Colon, valves only. Described from South Carolina.

Eurytellina angulosa (Gmelin).

Tellina angulosa Gmelin, Syst. Nat. ed. xiii, p. 3244, 1791.

One from Colon, dead. A West Indian species closely related to *punicea* Born.

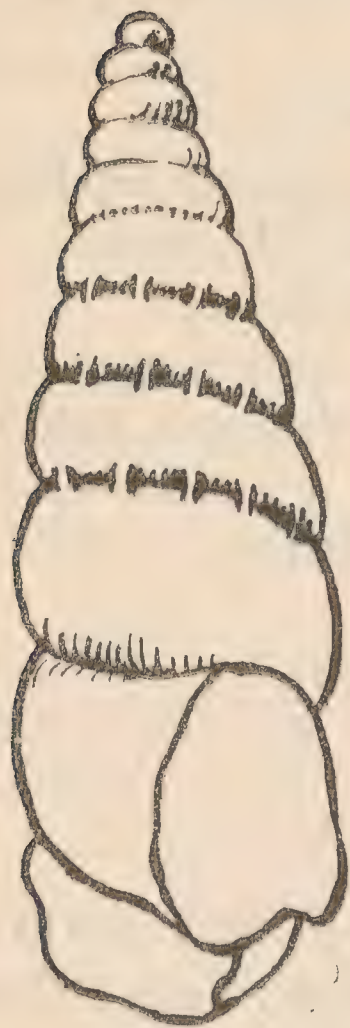
Eurytellina trinitatis n. sp.

Nearest to *prora* Hanley from the Pacific side of the Isthmus, but rather more convex, more glossy and shining and at times somewhat iridescent; colour a brighter pink than *prora*, *angulosa* or *punicea* and distinguished at once from all three by the fineness of its concentric striæ, which are hardly noticeable to the naked eye, whereas in the three species mentioned the striæ are deep cut and very patent; the shape is more like that of *angulosa* but less cuneate, having the breadth less in proportion to length than *punicea*—the commonest West Indian *Eurytellina*.

Length 19.5 mm. : breadth 32 mm. : maximum thickness 7.5.

Hab. Colon Harbour, not uncommon, dead but very fresh in 5 f.

Type. in Brit. Mus.



Bistomatism in *Delima gibbula* Zgl.—This was taken in Rome on a part of the old wall that was formerly the Palace of Julius Cæsar on the Palatine Hill. This species was in abundance in the crevices in the cement attached to the stones of that ancient structure. I find that in papers communicated to the "Lancashire Naturalist" for Nov. and Dec., 1910, Mr. J. W. Jackson refers fully to previously recorded cases of a double aperture occurring in *Clausilia*; but so far as I can discover no reference has been made to the abnormality occurring in this species. The shell is 11 mm. in length, and is slightly imperfect, the second mouth being only partly formed.—W. T. ELLIOTT (*Read before the Society*, Nov. 2nd, 1927).

MARKED PREFERENCE OF CERTAIN MOLLUSCA FOR SPECIAL ALGÆ OR ZONES.

By A. GARDINER, B.Sc.

(Read before the Society, May 12th, 1928).

Patina pellucida (L.) prefers *Laminaria saccharina*, and to a less extent *L. digitata* and *Rhodymenia palmata*: Falmouth, St. Ives, Chideock, Pembroke coast.

Acmaea virginea (Müller). *Cystoseira ericoides* and *Chondrus crispus*: Falmouth, Pembroke coast.

Onoba striata (J. Adams)
Craspedochilus cinereus (L.) } Under stones, rich in diatoms
quite near high-water-mark: Falmouth, Chideock.

Phasianella pullus (L.). On *Padina pavonia* and *Ptilota plumosa*: Chideock, and on the latter alga at Falmouth and on the Pembroke coast.

Lacuna pallidula (da Costa).

On *Fucus serratus* at Falmouth.

Littorina obtusata (L.). On *Fucus nodosus* and *F. vesiculosus*.

Littorina neritoides (L.) }
Lasæa rubra (Mont.) } *Lichina confinis* and *L. pygmæa*:

Falmouth, Dorset and Pembroke coasts.

Bittium reticulatum (da Costa)
Zippora membranacea (J. Adams)
Calliostoma striatum (L.) } On *Zostera marina*, and

also dredged in Falmouth Harbour in 6-10 fathoms.

Rissoa parva (da Costa)
Rissoa inconspicua Alder } On *Plocamium coccineum* and
Nitophyllum laceratum: Falmouth, Dorset and Pembroke coasts.

Acanthochites fascicularis (L.). Under stones in rock pools, but far more common crawling about on perpendicular rocks near low water. They seem to prefer spots without large algæ and not overhung by *Fucus*. They are generally above a shelf which would prevent them falling far: Falmouth, Chideock, Pembroke coast—especially Tenby.

Patella athletica Bean. Often found in pools of quite a high zone and not far down as generally stated: Falmouth.

P. vulgata var. *picta* Jeff.
„ var. *intermedia* Knapp } Shallow pools in high zone
with *Corallina officinalis*: Cornish coast and Tenby.

Littorina littorea (L.). Often in high zone with *Cladophora*, *Ulva* and *Enteromorpha*. I have found it in this position in greater numbers than near *Laminaria*: Falmouth, Helford.

Pholadidea loscombiana Goodall.

With *Pholas dactylus* L., *Barnea candida* (L.) and *B. parva* (Pennant): soft Jurassic formations at Chideock, Dorset.

Lacuna divaricata (F.). Dredged in great numbers at Falmouth Harbour, 10-12 fathoms.

Melanella polita (L.). Once dredged in great numbers in Falmouth Harbour.

A GARDEN FAUNA.

By A. E. ELLIS.

(Read before the Society, September 1st, 1928).

THE following list of twenty-three species from the old walled garden at Court House, Haverfordwest, is an unusually long one, and comprises some species not commonly occurring in such a situation: *Testacella haliotoides* Lam. (and also a whitish variety), *Lauria cylindracea* (Da Costa) in large numbers on the stone walls, amongst ivy, and under stones on the ground, *Pyramidula rupestris* (Drap.) on walls, *Cochlicopa lubrica* (Müll.), *Balea perversa* (L.) on the slate-tiled roof of an outhouse, *Clausilia rugosa* Drap. frequent in the same situations as *L. cylindracea*, *Goniodiscus rotundatus* (Müll.), ditto var. *alba* Moq., *Arion circumscriptus* Johnston, *A. hortensis* Fér., *A. subfuscus* (Drap.), *Helicella caperata* (Montagu) on leaves of kidney beans, *Trichia hispida* (L.) amongst *Convallaria majalis*, *T. striolata* (Pfeiff.), ubiquitous, *Helix aspersa* Müll. (far too abundant), *Oxychilus cellarius* (Müll.), *O. draparnaldi* (Beck), frequent, *Vitrea crystallina* (Müll.), *Vitrina pellucida* (Müll.), *Milax sowerbyi* (Fér.) in immense numbers, *Agriolimax agrestis* (L.), abundant, *Limax maximus* L. (feeding on fungi growing on rotten wood), *L. marginatus* Müll. (= *arborum* Bouch.-Chant.), on apple trees, Cos lettuces, and amongst Iris, and *L. flavus* L. I have seen *A. subfuscus* on Cos lettuces on one or two occasions. With the exception of a few odd corners the whole garden is under cultivation, and the kitchen portion, where most of the mollusca occur, is about half-a-rood in area.

THE HABITATS OF VERTIGO LILLJIBORGI West. IN IRELAND.

By A. W. STELFOX, M.R.I.A.

(Read before the Society, February 6th, 1929).

So little has been published concerning the habits of this little-known mollusk since the announcement of its re-discovery in Co. Galway by the late Dr. Chaster and Mr. J. R. le B. Tomlin in 1902,¹ that it is perhaps well to bring our knowledge of it up-to-date. It was first taken in Ireland in 1845 by Gwyn Jeffreys "under stones by the side of a small lake at Ballinahinch, near Roundstone, Co. Galway," and at first erroneously recorded by him as *V. moulinsiana* Dupuy.² Subsequent to the discovery of the genuine *V. moulinsiana* in England, Jeffreys stated that he believed the shells from Co. Galway were *V. lilljeborgi* Westerlund.³ Then followed a period of twenty-four years during which no attempt appears to have been made to obtain further specimens and the record became little more than a legend. Since 1902, however, it has been taken in West Galway, either at Ballinahinch Lake or at Cregduff Lough, near Roundstone by various collectors, including R. J. Welch, R. A. Phillips, the writer, J. R. le B. Tomlin and the late Dr. Chaster, R. Standen, J. N. Milne, C. E. Wright and E. Collier.⁴ R. A. Phillips found it also (May 1909) living in a layer of decaying reeds and bulrushes on the broad marshy margin of a small lake, not named on the map, about one mile south-west of Ballinahinch Lake.

In 1907 I took a single specimen under a stone on the shore of Lough Allua, near Macroom, in West Cork, but did not recognise it until three years later and recorded it at the time as *V. antivertigo*.⁵ In 1909, and again in 1914, I took it on the shore of Glenade Lough, Co. Leitrim, amongst boulders, near the outlet. Except for Mr. R. A. Phillips, I know of no one who has taken it since 1914, though I feel sure that it must have a wide range on the stony shores of our western Irish lakes and there seems no reason why it should not also occur on the shores of those of Scotland or even in the Lake District of England. With a view to studying its habits more closely, Mr. Charles Oldham and I decided to spend a few days in West Galway during September, 1928, but as so often happens in the west, our arrival was heralded by an exceedingly wet spell, the torrential rains

1. *Irish Nat.* xii, pp. 13-14, 1903.

2. *British Mollusca*, vol. 1, p. 255.

3. *Ann. Mag. N.H.*, p. 380, 1878.

4. See *Irish Nat.*, xvi, p. 359, 1907.

5. See *Irish Nat.*, xvi, p. 281, 1907, and *Proceedings R.I. Acad.*, xxix, p. 100, 1911.

raising the level of all the lakes in the district so much above the normal that the zone of *V. lilljeborgi* was under several feet of water. Even the little Cregduff Lough, near Roundstone, was too flooded and the shaking of flood refuse—which produced specimens in 1906—did not reward us with a single specimen. This method of collecting was also tried in many other places, at Ballinahinch and elsewhere.

After waiting nearly a week, Lough Inagh, the uppermost lake drained by the Ballinahinch River, had run down sufficiently to expose a wide, stony foreshore, and we decided to search its S.E. corner on our last day. We were fortunately favoured with a “pet” day and commencing work about half-a-mile apart and working towards each other, we had accumulated a number of *Vertigos* when we met a couple of hours later, amongst which each of us had one very juvenile *V. lilljeborgi*, numerous *V. antivertigo* and a few *V. pygmæa*. As I had failed to find more where my specimen had been taken after a prolonged search, we decided to go back to where Mr. Oldham had taken his and after some time met with an almost pure colony of the species where the stones were small, the shore flat and very wet and the vegetation was accompanied by a plentiful growth of two species of moss. In this place, which, except for the presence of the two mosses, did not appear to differ greatly from the remainder of the shore, we found quite a number of specimens varying in age from very old adults to mere babies, but no other *Vertigos* were seen although not far away *V. antivertigo* was by no means rare. I have said that where the colony of *V. lilljeborgi* occurred the lake shore was very wet, but how much this was due to the recent submergence—a few days previously the spot had been under at least four feet of water—and how much to the possible presence of springs, only a visit during dry weather would reveal, but the presence of the mosses only at this spot suggested a small spring.

I have to thank the Rev. W. R. Megaw of Belfast for identifying the mosses, amongst the stems of which and under the stones the *Vertigos* were living. Except where the mosses were thickest, the other plants formed an open association, which was rather a medley, some belonging to the permanent flora of the lake shore, and others derived from chance seedlings thrown up by the waves. In the hope that it may guide others to discover this rare shell in new localities, I give a list of the plants growing where the colony of *V. lilljeborgi* was found.

Flora, etc., of the S.E. shore of L. Inagh, amongst which *Vertigo lilljeborgi* occurred :

Dominant. Small stones (one to six inches diam.). *Juncus lamprocarpus* and *Eleocharis multicaulis*, with the mosses *Hypnum*

scorpioides and *Bryum pallens*. Also *Juncus bufonius*, *Carex glauca*, *C. æderi*, *Prunella vulgaris*, *Potentilla erecta*, *Anagallis tenella*, *Hydrocotyle vulgaris*, *Scabiosa succisa*, *Molinia cærulea*, more or less in order of abundance, with isolated plants of *Bellis perennis*, *Taraxacum officinale*, *Viola* sp., *Spiræa ulmaria*, *Senecio aquaticus*, *Leontodon autumnalis*, *Plantago lanceolata*, *Ranunculus flammula* and *Linum catharticum*; as well as a few specimens of *Limnæa palustris*, *L. truncatula*, *Agriolimax lævis*, *Punctum pygmæum*, *Carychium minimum* and *Pisidium personatum*.

COCKLES KILLED BY FROST.

BY R. J. WELCH.

(Read before the Society, February 6th, 1929).

IN the Editorial Notes of the Journal for December last a reference is made to the Ministry of Agriculture and Fisheries Report on Cockle Beds, and the statement in it that immense havoc is often caused by frost and sun's rays. This seems to be the case on the sand flats of Belfast Lough between the mouth of the harbour and Whitehouse. Years ago, the B. & N. C. Railway Engineer, the late Berkeley D. Wise, M.I.C.E., put in a lot of old railway sleeper groynes to protect the embankment of the railway, and a year or two afterwards he called my attention to the fact that large quantities of dead cockle shells were collecting on the side of the groynes facing the open sea.

Since Mr. Wise's death immensely larger quantities of cockle shells have been collected by the groynes and at Greencastle, where people bathed and dived not so many years ago, there is now a cockle beach well above high-tide mark in its upper part. I think this mortality must have been, partly at all events, caused by frost. A thick bed of cockle shells was cut through when the new Harland Channel out of the harbour was made about 45 years ago, and there are large numbers in a thick shell bed only two or three feet below the street level, over a wide area in the lower part of Belfast, which is built on piles driven deeply through estuarine clay and sand, to boulder clay or Triassic rocks below. This shell band has myriads of *Bittium reticulatum* in it, that species far outnumbering the others present.

NOTES ON THE NAMED VARIETIES OF *CYPRÆA MILIARIS*
Gmelin, AND ITS RELATIONSHIP TO *CYPRÆA EBURNEA*
Barnes.

By HUGH C. FULTON.

(Read before the Society, November 7th, 1928).

A VARIETY occurs of *Cypræa miliaris* which ranges in colouration from light-brown to almost white, with more or less conspicuous white spotting, some specimens connecting up with *Cypræa eburnea* Barnes. This variety has been given five varietal names, viz. :—

1. **Miliaris** v. **diversa** Kenyon. Jour. of Conch. Vol. X,
1901, p. 184.
Hab. Sharks Bay, W. Australia.
2. **Miliaris** v. **brookei** Rous. Nautilus, Vol. XIX, 1905, p. 29.
Hab. Philippines.
3. **Miliaris** v. **nivea** Preston. Nautilus, Vol. XXII, 1909, p.
121. Hab. N. E. Queensland.
4. **Miliaris** v. **intermedia** Maxwell Smith. Nautilus, Vol.
XXVII, 1913, p. 70.
Hab. unknown.
5. **Miliaris** v. **gabrieli** Gatliff & Gabriel. Victorian Naturalist,
Feb. 1916, p. 148, fig. 3.
Hab. Victoria.

Mrs. Kenyon states that this variety proves that *miliaris* is distinct from *eburnea*, whilst Mr. Maxwell Smith considers that it links up the two species. According to Mrs. Kenyon the interior of *miliaris* is violet, whereas that of *eburnea* is either white or orange colour. Judging by the numerous specimens I have examined this interior colouration is true in the majority of cases but not always. The authors of vars. 1 to 4 all agree that their shells are white spotted; the var. *gabrieli* "has not the slightest trace of any spots," this is probably the fawn-coloured variety of *eburnea* that links up that species to *miliaris*. The white spotting on this variety is more or less conspicuous and can sometimes be very faintly traced on white specimens that one would certainly put with *eburnea*.



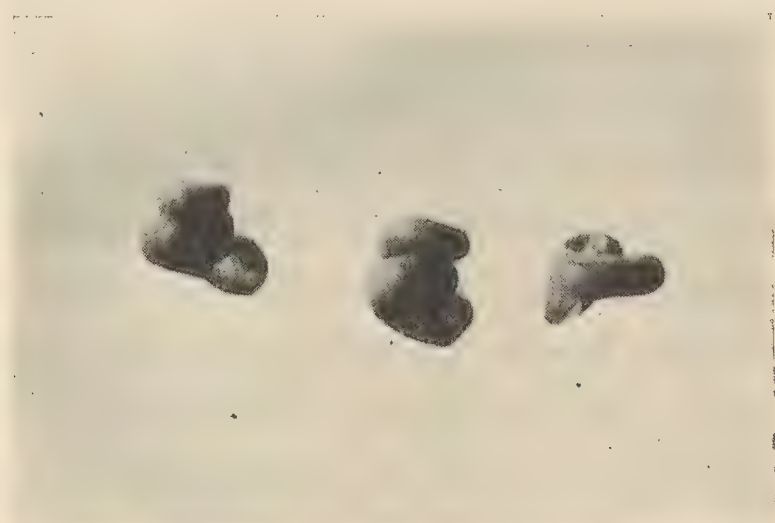
PLANORBIS LÆVIS Alder (=GLABER Jeff.) IN E. SUFFOLK.

By J. E. COOPER.

(Read before the Society, November 7th, 1928).

THE chance discovery of a caddis-case covered with *Planorbis lævis* at the conclusion of my holiday at Aldeburgh in 1927 caused me to revisit the place last July.

In part of one of the ditches near the sea this *Planorbis* was found in abundance. It was living chiefly on the ivy-leaved duckweed (*Lemna trisulca*), which does not form thick mats on the surface of the water like other duckweeds, but allows light and air to reach the inhabitants of the ditch.



Other parts of the same ditch were thickly covered with the common duckweed (*L. minor*) which appears to suffocate most mollusca. *Limnæa palustris* alone thrives on the surface of the weed.

At Southwold, thirteen miles further north, a very few *Plan. lævis* were collected from a ditch covered with common duckweed.

The associated mollusca at Aldeburgh were *Limnæa peregra* and *Paludestrina jenkinsi*; at Southwold the same two species and a few *Planorbis umbilicatus*.

Amongst the Aldeburgh shells were two scalariform specimens and one deformed sinistral example.

Marine Mollusca from a raised beach in Cornwall.—About half-way between Carne and St. Anthony—near Manaccan, Helston—the bank of the lane running alongside the north side of Gillan Creek, about fifty feet above present water level, has been cut away for a short distance to widen the road. This cutting has exposed, about a foot below the present surface, a band some eighteen inches wide which is whitish because of the shell fragments contained therein. These remains are mainly very small, broken pieces, but a few whole or slightly broken shells are to be found. I obtained the following, viz: *Littorina littorea* (L.), *Nassa reticulata* (L.), *Bittium reticulatum* (Da C.), *Gibbula umbilicata* (Mont.), *Dosinia exoleta* (L.), *Tapes* sp. and *Venus gallina* (L.).—G. C. SPENCE (Read before the Society, Nov. 7th, 1928).

AGRIOLIMAX LÆVIS (Müll.) A WOODLAND SLUG.

By C. OLDHAM.

(Read before the Society, January 2nd, 1929).

SWAMPY meadows, the margins of lakes and streams, and wet places in the open, which perforce are often submerged, are characteristic habitats of *Agriolimax lævis* in this country. There it is usually associated with such species as *Succinea pfeifferi*, *Vertigo antivertigo* and *Zonitoides nitidus*, especially the last. It can evidently accommodate itself to very diverse conditions; I have found it on the bones of a white-fronted goose in the middle of the great Tregaron Bog in Cardiganshire, the acid peaty soil of which would ban most snails, and it has been recorded from sandy places, hot and dry in summer, on Braunton Burrows (Taylor, "Monograph," vol. ii, p. 125). Entries in an old note-book remind me that I collected *lævis* in woods at Gunthwaite, near Penistone, Oct., 1892; Oakley, near Kettering, Dec., 1894; Bollington, near Macclesfield, Sept., 1895; and at Weaverham, Cheshire, April, 1902, but after this lapse of time I cannot recall the exact circumstances. It is not infrequent in alder thickets and in swampy places in woods that are permanently wet. Stelfox (*Proc. Roy. Irish Acad.* vol. xxix, sect. B, No. 3, p. 74) cites "moist woods" as an Irish habitat, but in England at any rate it seems to be rare as a member of a typical sylvan association. This note is prompted by some experiences of my own in the spring of 1928, and may elicit information from others about the sort of places in which this slug lives.

At Great Gaddesden, Hertfordshire, the chalk downs rise rather steeply from the valley of the Gade, and on the top of the hill half a mile south of the village is Highpark Wood. The greater part of the wood is on clay-with-flints overlying the upper chalk, but at its eastern and western extremities the chalk is exposed. Most of the trees are oak and hazel (perhaps planted on the site of an ancient beech-wood) and there are old beeches on the chalk at the western end. At one place on the clay-with-flints area is a patch of *Allium ursinum*, a rare plant in the Chiltern woodlands, and one which, with the associated *Scilla nutans*, *Ranunculus ficaria* and *Mercurialis perennis*, suggests damp, although the ground at this spot is in summer dry and hard. Here at the end of March were found many *lævis* under pieces of bark and fallen branches, associated with *Carychium minimum*, *Patula rotundata*, *Arion circumscriptus*, *A. hortensis*, *A. intermedius*, *A. ater*, *Clausilia rugosa*, *C. laminata* (many), *Hygromia hispida*, *Theba cantiana* (one, which may have strayed from the hedge-bank at

the edge of the wood twenty yards away), *Euconulus fulvus*, *Hyalinia nitidula*, *H. alliaria*, *H. helvetica*, *H. crystallina*, *Vitrina pellucida*, *Agriolimax agrestis* and *Limax arborum*. Other *lævis* were found in different places on the clay-with-flints and one among dead beech leaves in the definitely chalky area.

On April 21st I found *lævis* in Hales Wood and Little Hales Wood, oak-hazel woods on the chalky boulder-clay near Saffron Walden, Essex. The floor of the woods was yellow with the flowers of *Primula elatior* and growing with it were *Anemone nemorosa*, *Mercurialis perennis*, *Arum maculatum*, and *Ranunculus ficaria*, plants indicative of the fairly high water-content of the chalky boulder-clay, but no doubt the ground here, as at Great Gaddesden, is baked hard in summer. The molluscan association—characteristic woodland species—was similar to that at Great Gaddesden and included *Clausilia laminata* and *Limax arborum*, unusual companions, surely, of *Agriolimax lævis*.

Stray Notes.—*Clausilia laminata* Mont. Most collectors, I believe, find this and some other tree climbers chiefly on beech trees, but this is not my experience in northern England, where in woods sycamores are nearly always chosen. *Planorbis corneus* L. This seems to be the favourite snail with dealers who supply aquarium specimens. A collector for such dealers whom I met at Cambridge told me that the popularity of *P. corneus* was due to its “eating up all the dirt and making no dirt itself.” The var. *albina* was fairly common some years ago in a polluted canal near Shrewsbury. *Neritina fluviatilis* var. *cerina* Colb. may be found in the canal at Retford. *Limnæa palustris* Müller. I have before me a giant specimen of this, measuring 33 mm. in altitude, taken from a pond in Cheshire. *Succinea elegans* Risso I have never found equal in size to those figured by Sowerby and by L. E. Adams.—J. R. le B. T.

HELICELLA DRAPARNALDI (Beck.) m. SINISTRORSUM AT COULSDON, SURREY.

By F. TAYLOR.

(Read before the Society, April 6th, 1929).

DURING a brief visit to the Coulsdon district of Surrey on the 25th October, 1926, I investigated a small refuse tip at the junction of Chipstead Valley Road and Portnalls Road; and found a prolific and varied molluscan population of seventeen species. The most interesting to me was a large colony of *Helicella draparnaldi* Beck, fine mature specimens. No eggs of the species were found on this occasion.

A subsequent visit on the 23rd December, 1928, proved very productive; *H. draparnaldi* was still numerous, and egg-laying seemed general; hundreds of the calcareous eggs of the species were found in moist earth several inches below the surface of the tip. A quantity of these eggs was brought away to make into cabinet specimens, but most of them exploded whilst drying at a low temperature. Many of the snails had evidently died after laying their eggs, and their shells had been cleaned out by other animals and probably their own species. One of these was of the rare sinistrally coiled monstrosity, in good condition, and only recently dead, as it contained a small portion of the animal. This monstrosity of *H. draparnaldi* is evidently very rare, and probably the first recorded occurrence for the British Isles.

A continental record from C. F. Ancey's Bull. Sci. France et Belgique 1906, vol. xl. p. 188 briefly states:- "*Polita lucida* Drap. Pyrénées (coll. Ancey)." Thanks are due to Messrs J. W. Taylor, Dr. J. W. Jackson and Prof. A. E. Boycott for tracing this, the only previous record so far obtainable.

Associated with *H. draparnaldi* were:—*M. sowerbyi*, *M. gagates*, *A. circumscriptus*, *L. maximus*, *L. flavus*, *A. agrestis*, *G. rotundatus*, *H. cellaria*, *H. rogersi*, *H. nitidula*, *E. obscura*, *H. aspersa*, *H. hortensis*, *F. striolata*, *F. hispida*, *T. cantiana* and probably others would be found on a closer investigation.

A NEW RACE OF AUSTRALIAN HELICIDÆ.

BY PROF. T. D. A. COCKERELL.

(Read before the Society, November 7th, 1928).

JENNINGS, New South Wales, is a village on the border line between Queensland and New South Wales, at an altitude of 2875 feet. The part of the town on the Queensland side is called Wallangarra, and is well known as the place where travellers from Brisbane get their supper and their sleeping car. It is an open grassy country, with low hills, and Eucalyptus trees everywhere. When hunting for insects, April 25, I found a species of snail in considerable numbers under logs, but mostly immature. The first one I put in alcohol and later I collected two adult shells, but afterwards passed them by, supposing that they must be very well known. To my surprise, when I looked them up at the Australian Museum at Sydney, with the kind help of Mr. T. Iredale, I found that I had a distinct new type, though not worthy of specific rank. It may be described as follows:

Hadra corneovirens Pfeiffer race **ianthostoma** nov.

Shell subglobose with moderately elevated obtuse spire; whorls $5\frac{1}{2}$, rounded externally, with irregular growth rugæ and a very fine papillose sculpture, most distinct on penultimate whorl, where there is an appearance of fine lines of pustular dots, both transverse and longitudinal, but in no case following or parallel with the rugæ; on the last whorl these markings are evanescent, and the surface is shining. The shell is reddish brown above, paler below, wholly without bands; aperture broadly rounded, lip distinct, umbilicus closed; umbilical region broadly dark purplish brown; lip deep purplish within, the actual margin paler, lilac tinted. Animal pale ochreous.

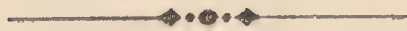
Holotype with alt. 19.5; diam. max. 27, min. 22 mm. Another has alt. 17; diam. max. 22.5, min. 20 mm. Except for the variation in sizes the race appeared to be quite uniform. Type from Jennings, N.S.W.; also occurs at Wallangarra, Queensland.

Comparison has been made with all the related forms, and ours appears sufficiently distinct. Holotype placed in the Australian Museum. The snails called *H. gulosa* Gould, *H. corneovirens* Pfr., *H. jervisensis* Quoy and Gaimard, *H. bednalli* Brazier, *H. bennetti* Brazier, *H. mastersi* Cox, *H. monacha* Pfr. and *H. mulgoa* Cox appear, judging from the shells, to be races or subspecies of a single species. Many lots ascribed to *H. gulosa* were examined, and it appears that the true *gulosa* is more strongly papillose all over, has a white lip, and usually, at least, lacks the dark patch in the umbilical region. A very large variety (*coriaria* Pfr.) has been described. *H. corneovirens* Pfr. also

has a white lip, and resembles our shell in the evanescence of the papillose sculpture on the body whorl. In shape, and the relatively thin shell, *corneovirens* and the new form agree. *H. jervisensis* typically has the umbilicus perforate or open; the lip is white, and the dark umbilical patch is present more or less distinctly. *H. grayi* Pfr., considered a variety of *jervisensis*, is very like our shell but paler, and with white lip, umbilicus closed, sculpture about as in *H. gulosa*, dark umbilical patch present. *H. bennetti*, from Ipswich, Queensland, is very similar to our shell, but paler, and without the purple umbilical region, etc. The southern *H. bednalli*, from Adelaide, is umbilicate and has a white lip. *H. mastersi* is ferruginous, very variable in size according to the material so labelled. *H. monacha* is like the large *mastersi*. *H. mulgoa* (Penrith, N.S.W.) is pale yellowish with a white lip.

These shells have been called *Hadra*, *Thersites* and *Badistes*. The reference to *Hadra* is made pending a discussion of the whole matter which will be given later by Mr. Iredale. Far to the north, in tropical Australia, *H. expeditionis* Cox is a shell closely resembling our series; umbilicate and with a white lip, recalling the southern *H. bednalli*. *H. greenhilli* Cox (Dawson R., Queensland) is also of the same general appearance.

The only other mollusc we obtained was *Agriolimax lævis*, a couple of specimens found on the Queensland side by my wife.



A NOTE ON THE MARINE CONCHOLOGY OF ST. LEONARDS-ON-SEA.

BY J. WILLIAMS VAUGHAN.

(Read before the Society, February 6th, 1929).

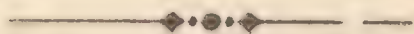
IN November last, soon after the meeting of the Society in London, I went to St. Leonards for a fortnight, and whilst there amused myself by seeing how many different species of shells I could find on the beach. I found St. Leonards not a good place for shells, and only took thirteen species.

Donax vittatus da Costa was by far the most abundant, quite common, both living and dead all along the shore. I found three valves of *Macra stultorum* L., which I should say by their appearance had not long been without the animal, and one valve of the var. *cinerea* Mont., three valves of *Tapes pullastra* Mont., and one young shell with both valves, all of which appeared not to have been long dead.

I found two valves of *Tellina tenuis* da Costa in a good state of preservation. It is a puzzle to me how these fragile and beautiful little shells manage to survive the fierce pounding of the waves when the sea is at all rough. I found *Patella vulgata* L. common and abundant on all rocks between the tide marks and *Purpura lapillus* L. was also abundant; an almost black variety occurred in some numbers. The shells got much lighter in colour when dry.

Littorina littorea L. occurred very sparingly, and was of very small size. I only found two specimens of *L. obtusata* L. *L. rudis* M. & R., on the contrary, was fairly common on rocks near high water and on the sea walls.

I found three specimens of *Nassa incrassata* Ström. and five *Trivia europæa* Mont. on the sand near the low water mark. *Mytilus edulis* L. occurred in rather large patches on the rocks, and I found one valve of *Cardium edule* L. which had evidently been a long time dead.



VARIATION IN THE SHELL OF *H. LAPICIDA* L.

By A. E. SALISBURY.

AT Lynton, Devonshire, in June of last year, I had the opportunity of taking *lapicida* in considerable numbers, and on one very wet day I counted all that I could see on a certain length of wall, measuring the adult specimens. The shells varied from the usual dark form through a very pretty form of shell, which has the appearance of tortoiseshell, to the white form, the percentage of these forms being approximately: normal, 10.5%; tortoiseshell, 62%; and white 29%.

It is difficult to separate or draw an accurate line of demarkation between the normal and what I have called the tortoiseshell form because they so gradually grade into one another, but the above figures show that the tendency to albinism in the shells of this locality is extremely marked, some of the middle form being only just tinted in patches. The size of the shell varied as follows: Alt. max. 7.8 mm., min. 6.6 mm.; Diam. max. 17.5 mm., min. 15.5 mm. I might add that none of the animals were albinos although some were distinctly paler than others, but some of the animals of which the shells were white were as dark as any.

OBITUARY NOTICE: J. A. HARGREAVES.

By W. GYNGELL.

JOHN ASHWORTH HARGREAVES was born at Lumb, Rossendale, Lancashire on April 10, 1856. His father was the owner of a cotton-weaving mill. Educated at Burnley, Hargreaves had a long walk daily over the moors to and from his native village. Then began his working life at the mill, but this not being to his taste he left his father's business and became a schoolmaster at Baildon-Woodhouse, near Bradford, Yorks. He married Susannah Spencer, the daughter of a Lancashire quarry owner whose interest in fossils possibly inspired Hargreaves; at any rate the taste for science displayed early in life continued until its close. Making congenial friends in Bradford and neighbouring towns, the remains in extinct animals and plants soon gave place in interest to living species and he joined the Conchological Society in 1887.

But he was not doomed to spend all his life teaching in the smoky and depressing atmosphere of large cities. In 1888 he purchased a bookselling and stationery business at Scarborough and continued the business from that time until near the close of his life.

Natural History had few students at Scarborough in 1888 but the following year saw the birth of the Scarborough Field Naturalists' Society with workers springing up in most fields of interest.

The author of this short memoir recalls many pleasant rambles along shores; with such incidents as the discovery of a Shap-Granite boulder, tons in weight, or watching the slow slip and fall of another huge erratic from the boulder clay cliff almost to our feet; our first finding of the mineral Scarborite; wandering to the Speeton Clay and Red Chalk and home-coming with ammonites glittering with iron pyrites and belemnites like short pointed slate pencils: giant footprints on rocks: pockets bulging with huge fossil *Phasianella* and dainty Echinoderms from Coral Rag quarries.

One of Hargreaves' most enjoyable excursions further afield was made with the late Robert G. Gilchrist, an ardent naturalist cut off in his prime; they visited the Norwich Crag formation, famous for reversed *Neptunea antiqua*.

But it is as a Conchologist that Hargreaves will be most remembered. In the field his ready identification of a *Vertigo* or a *Vitrea* were most helpful to those of less experience, whilst an evening at home with him and a tin full of shell-sand was most entertaining.

Of sturdy physique in appearance Hargreaves seemed to remind one of familiar portraits of Charles Darwin. Endowed with a good

memory he was a welcome help when visiting a friend; yet his own collection was not the perfection of order; cabinet drawers, not all closed, might contain anything but Natural History specimens. There were fossils on the top of the kitchen boiler! He usually kept some sort of an aquarium, marine or fresh-water, and his last bell-jar probably contained a brood of *Limnaea pereger*, dextral and sinistral, breeding.

Hargreaves' latter years were distressed by frequent attacks of asthma, alternating with severe dyspepsia and at times life to him was not worth living. In order to obtain relief from asthma various districts in England were visited and a trip to Italy was taken but with little or no result. Lincoln was the last city visited and here he died and was buried at Scarborough. Some four years ago Hargreaves sustained the blow of his life in the sudden loss of his devoted wife through pneumonia. Soon after this sad event he disposed of his Scarborough business and returned to Leeds.

He was a very early member of the Conchological Society, the Yorkshire Naturalists' Union, Yorkshire Conchological Society, a trustee of the Scarborough Philosophical and Archæological Society, and a foundation member of the Scarborough Field Naturalists' Society. He contributed the following papers to this society:

Journ. of Conch. XII, p. 229: Land and F.-W. Mollusca
in Scarborough district.

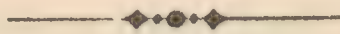
„ „ „ p. 331: On a Habitat of *Acicula*
lineata.

„ „ XIII, pp. 80,99: The Marine Mollusca
of the Yorkshire coast
and the Dogger Bank.

„ „ „ p. 215: Protective Resemblance
in British Marine Mol-
lusca.

„ „ XVI, p. 55: Sinistral *L. peregra* Müller
and its Progeny.

Hargreaves loss will be deplored by many friends but by none more than the author of these lines, for his departure closed a family as well as a personal friendship of nearly forty years. He is survived by three sons and two daughters.



NOTE ON ADULA SIMPSONI (Marshall).

By J. DAVY DEAN, F.E.S.,
Of the Department of Zoology, National Museum of Wales.

(Read before the Society, December 5th, 1928).

DURING the summer of 1928 a trawler belonging to Messrs. Neale & West brought into Cardiff Docks the skull of a whale. This, on examination, was found to be studded all over with a small mussel which was unknown to me. The smaller specimens occurred on the smooth, more exposed, parts of the skull; the larger individuals in the crevices. Mr. R. Winckworth kindly identified the species as *Adula simpsoni* (Marshall).

The trawling grounds of the Cardiff boats lie from the Smalls to the southward and westward of Ireland. Owing to the fact that the skull was of little use as a specimen and that some time was allowed to elapse before the shells were examined, it is not now possible to give the exact locality. The few previous records for this peculiar mussel come from the north-east coast of Scotland. The first was in 1900. A whale's skull, trawled 150 miles N.E. of Aberdeen, was found to be covered with a small mussel, then unknown. Specimens were sent by James Simpson to J. T. Marshall, who described the species as *Myrina simpsoni*.¹

A year later Marshall substituted *Adula* for *Myrina*, on the advice of E. A. Smith, and recorded further specimens taken on another skull of a whale trawled 20 miles N.W. of Fair Isle, between the Shetlands and the Orkneys, and landed at Aberdeen. A piece of pitch pine, also landed by a trawler at Aberdeen, was found to be full of *Xylophaga* and *Teredo* and in the deserted tubes were *Adula simpsoni* in fair numbers.² Marshall also records much larger specimens³ from the broken jaw of a whale about the same time. The peculiar affinity of *Adula* for whales' skulls and bones is worthy of note.

Mollusca eaten by Rabbits.—When on a holiday in the North of Ireland during August, 1927, I spent some time searching for mollusca on the sandhills which fringe the East Strand at Portrush. I found large numbers of dead shells of *Helix nemoralis* Linné and *Helicella itala* (Linné), the whorls of which had been bitten through on one side, the mouth in most cases remaining undamaged. All these shells were either upon the heaps of sand thrown out by rabbits from their

¹ J. of Malac. vii, p. 167.

² op. cit. viii, p. 19.

³ J. of Conch. xiv, p. 182.

burrows, or round the edges of "forms" made by rabbits upon little knolls, not far from the burrow entrance, and covered with rabbit droppings. The question of rats being responsible for devouring the molluscs is somewhat discounted by the fact that the mouth is so often undamaged, whereas a rat when devouring a snail generally gnaws away the shell from the lip across the body whorl. Most birds either drop the shells from a height upon hard ground to smash them, or seize them by the lip and hammer them upon some hard substance to break up the shell, and there is no hard ground or stone where these shells occur, only soft sand and short, mossy turf. It may be that field mice are responsible, but if this is the case it seems remarkable that the damaged shells were invariably found in the situations named above and not on the footpaths or other open spaces which occur all over the sandhills. There seems to be evidence here of a case parallel to that mentioned by Mr. J. W. Taylor in his Monograph, vol. iii, p. 281, where rabbits at Magilligan Bay were observed to eat *H. nemoralis*. Perhaps it is only in dry localities such as sandhills that rabbits vary their vegetarian diet by consuming such luckless molluscs as they happen to come across, and it would be interesting to have the experiences and opinions of other observers. The late J. Ray Hardy affirmed that he had watched water voles, which are vegetable feeders, devouring *Limnæa stagnalis*, L. and Mr. J. C. Dacie sends me specimens of *Planorbis corneus*, L. eaten by these creatures. In view of this and similar observations there seems no reason why other vegetable feeders should not develop similar habits.—A. K. LAWSON (*Read before the Society*, Nov. 2nd, 1927).

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND.

571st Meeting, held at the Manchester Museum, February 6th, 1929.

Mr. C. H. Moore in the chair.

Additions to Library.

"Some observations on the Mycophagous Propensities of Slugs," by Dr. W. T. Elliott.

"Die Kopulation von *Limax cinereoniger* Wolf," by B. Peyer and E. Kuhn.
And two papers by H. Schlesch (from the respective authors).

Candidates Proposed for Membership.

Professor Shintaro Hirase, Seikei High School, Zoological Institute, Seikeigakuen Kichijoji, Tokyo, Japan (introduced by H. Schlesch and W. T. Elliott).

William Hill, 6, New Street, Leek, Staffs. (introduced by John Hill and J. W. Jackson).

Papers Read.

"On the Habitats of *Vertigo lilljeborgi* West., in Ireland," by A. W. Stelfox, M.R.I.A.

"Cockles killed by Frost," by R. J. Welch, M.Sc.

"A Note on the Marine Conchology of St. Leonards-on-Sea," by J. Williams Vaughan.

"The Mollusca of the 'St. George' Expedition (II), The West Indies," by J. R. le B. Tomlin, M.A.

Exhibits.

By Mr. C. H. Moore:—A series of *Xesta*.

By Mr. A. K. Lawson:—*Littorina rudis*, from Loup Head, Co. Clare (above

high-water), also same species from a freshwater millpond at Walton-on-Naze; *Littorina obtusata* v. *æstuarii*, from Woodbridge, Suffolk (all collected by J. C. Dacie).

The Special Exhibit was *Pomatias*.

572nd Meeting, held at the Manchester Museum, March 6th, 1929.

Mr. G. C. Spence in the chair.

New Members Elected.

Prof. Shintaro Hirase.

William Hill.

Candidate Proposed for Membership.

Walter J. Eyerdam, R.F.D. 12, Box 744, Seattle, Washington, U.S.A. (introduced by H. Schlesch and W. T. Elliott).

The Special Exhibit was *Trochomorpha*.

573rd Meeting, held at Manchester Museum, April 6th, 1929.

The President, Mr. H. H. Bloomer in the chair.

New Member Elected.

Walter J. Eyerdam.

Paper Read.

"*Helicella draparnaldi* (Beck) mons. *sinistrorsum* at Coulsdon, Surrey," by Fred Taylor.

Exhibits.

By Mr. G. C. Spence:—Shells from S.W. Africa.

By Mr. F. Taylor:—Shells from Llandudno district, including species and varieties not previously recorded.

The Special Exhibit was Reversed British Land Shells, and the following examples were shown:—

By Dr. J. W. Jackson: *H. pomatia*, Box Hill; *H. aspersa*, Whalley, Lancs.; *H. nemoralis*, Clayton-le-Moors, Lancs.; near Burnley, Lancs.; near Otford, Kent; Bundoran; near Ballycastle, Antrim; Portstewart sand-dunes; *Pyr. rotundata*, Winnatts, Castleton, Derbyshire.

By Mr. F. Taylor: *H. aspersa*, Southport; Deganwy; *H. pomatia*, Coulsdon, Surrey; *H. barbara*, Tenby; *A. taylori*, Reddish, Lancs.; *V. vivipara*, Bardsley, Lancs.; *H. draparnaldi*, Coulsdon, Surrey; *L. peregra*, Leeds; *H. nemoralis*, Bundoran.

574th Meeting, held at the Manchester Museum, May 4th, 1929.

Mr. G. C. Spence in the chair.

Member Resigned.

Lady Davy.

Members Deceased.

J. C. Dacie.

J. A. Hargreaves.

Paper Read.

"English and German specimens of *Ceciloides acicula* (Müll.)," by Hugh Watson, M.A.

Exhibits.

By Mr. C. H. Moore:—Series of *Patula*.

The Special Exhibit was *Helicarion*.

EDITORIAL NOTES.

WE think that the death of Mr. Joseph Sinel in Jersey on April 2nd last, requires a short notice in our *Journal*. Though he was never a member of the Conchological Society his name must be familiar to many of the members, and some of us have had personal acquaintance with him in past years and appreciated his breezy enthusiasm and his keenness on marine zoology. Sinel was in his 85th year and had latterly been Curator of the Museum of the Société Jersiaise. He belonged to an old Huguenot family, and was an authority on archæology as well as on shore life. In his earlier years he had a flourishing Natural History business in Jersey. I remember his telling me how he determined to take up the mollusca more thoroughly, and wanting to add a supply of *Macra glauca*—then accounted a very rare British species—to his stock, he offered sixpence apiece for living specimens. Within a month or two the fishermen brought him over 500! He was a frequent contributor to *Science Gossip* and wrote books on the Geology of Jersey and on the Channel Isles in prehistoric times, but his most useful book to the Zoologist is "An Outline of the Natural History of our Shores," with 120 photographs from nature (Swan Sonnenschein & Co., 1906), illustrating almost every branch of marine littoral life. He had a son who predeceased him and a daughter who married Dr. James Hornell, at one time well known as the head of the Madras Fisheries Department, and more recently as one of the scientists of the "St. George" Expedition.

We regret very much to report the death of Mr. John Charles Dacie on April 22nd last, who had been a member of our Society for thirty-one years. For many years he has been Hon. Sec. of the London Branch and has given the use of his office near Cannon Street Station for their meetings. Born on May 15th, 1860, in Putney, where he lived the whole of his life, he was educated at King's College, London, and subsequently adopted the profession of accountant with special experience in the intricacies of Income Tax. In 1899 he married Miss Lilian Durrell, by whom he had three daughters, who still survive. Mrs. Dacie died in 1908 and a year later he married Miss Lilian Maud Vivian, who—together with a son and daughter—survives him. Dacie was a man of many interests; he was essentially an outdoor man and never so happy as when he was collecting in the field. He was a keen fisherman, and used to say that he had never read a novel or been to the theatre in his life. As showing the versatility of his interests, one may mention that at one time or other he belonged to the South London Entomological Society, was a member of the Battersea Field Club, a Fellow of the Imperial Institute, Chairman of the South West Choral Society, chairman of the Natural History section of the John Evelyn Club at Wimbledon, and an original member of the Society of Chemical Industry. In 1914, as related by Mr. J. W. Taylor in this *Journal*, vol. xv, pp. 11-12, Dacie discovered several recent examples of *Hygromia umbrosa* Pfr. at Margate. Two of these have just been presented by the family to the British Museum. In the same volume of this *Journal*, pp. 179-180, he described under the name of *Littorina rudis* var. *alticola* a notable form of periwinkle which habitually lives high above sea-level. He amassed a remarkable collection of British *Nucella lapillus* (L.) and *Littorina* from every available locality. We are glad to say that this has been presented to the British Museum. The rest of his varied collections was dispersed at Stevens' Auction Rooms on July 3rd.

An Index has recently been issued to the "Conchologists' Exchange" i and ii, and the "Nautilus" iii to xxxiv, published by Messrs. G. H. Clapp and Bryant Walker, and obtainable from the business address of the "Nautilus," 234, Berkeley

Street, Boston, Mass. It consists of two sections—an alphabetical list of authors and their papers (the latter listed chronologically), and an Index of Genera and Species. All species are cross-referenced under both generic and specific names, and apparently every occurrence of a name is indexed. At any rate more than 80,000 references are assembled. The bulk of the work is due to J. B. Henderson, Jr., and after his death in 1923, Dr. Dall completed the volume and edited it.

An admirable study of the molluscan fauna of an Alpine area is given by M. Georges Contagne in the Ann. Soc. Linn. Lyon, n.s., tome lxxiv, 1929. The paper is entitled “La Faune Malacologique de la Tarantaise,” and the Tarantaise is explained to be the basin of the River Isère above Albertville. Except for the outlet through Albertville, the boundary of the Tarantaise consists exclusively of rocks and glaciers, crossed only by passes of at least 2,000 metres in altitude. The lowest point of this basin is 340 metres above the sea, and its total area is about 1,890 square kilometres. The paper gives many ecological details, and the list itself is welcome and commendable in the way it discards what the author calls “locardies,” i.e. the pseudo-species which Locard and his school multiplied *ad nauseam*. Particular attention is paid to altitude and its effect on form, size and colouration.

The Ann. Soc. Roy. Zool. de Belgique, lix, fascicule 1-2 contains an illustrated article on “Copepods Parasitic on Mollusca,” by Prof. Pelseneer. Lamellibranchs undoubtedly form an excellent shelter for small Crustacea, and probably Brachiopods do too. Up to 1883 only three Copepods parasitic on Lamellibranchs had been described; at the present day a score are known, without any special research having been made, and probably they are really very numerous. Pelseneer relates how at first he transmitted his specimens to specialists, but as they neglected or lost them he determined to study them himself. In the present paper new parasitic Copepods are described from *Lucina lactea*, *Pholas dactylus*, *Barnea candida*, *Syndosmya alba* and *Doridium membranaceum*. A complete alphabetical list is given of the known Copepods from mollusca together with their hosts, and a good bibliography.

Les Mollusques post-glaciaires et actuels du Bassin de Genève. Jules Favre. 4°. Geneva, 1927. 20 francs. This monograph appeared in November as fascicule 3 of the ‘Mémoires de la Société de Physique et d’Histoire naturelle de Genève,’ vol. 40 (pp. 171-434, plates 14-27). It is good for British conchologists to get into touch with continental views, and in this book we have the result of a great deal of very careful work ably executed and clearly presented. The survey of variation in species is of special interest to us. One may instance his review of the *Radix* group of *Limnæa*; here he recognizes three forms as specifically distinct, *auricularia* L., *peregra* L. and *ovata* Drap. (= *lagotis* Schrank), where he is at pains to verify the absence of intermediate forms anatomically by dissecting a large number of the two latter forms. Again, in discussing the variation of *Valvata piscinalis* (Müller), he shows that such apparently distinct forms as *antiqua* Sow., *andreana* Menzel, *macrostoma* Steenbuch must be regarded as variations of this species; a long series of figures excellently reproduced helps to convince us that this opinion is right (I am very doubtful if the local British form we call *macrostoma* is really the *macrostoma* of Steenbuch). *Pisidium* receives ample treatment and eight and a half plates are devoted to it; the outline figures of the hinges of 15 species on pp. 288-289 offer a conspectus that should be useful when working out our own species. In fact as a manual of conchology the treatise is most useful. But undoubtedly the greatest

value of the work lies in the geological results, in the detailed working-out of the post-glacial deposits, their succession and age, and the very full evidence that the land and freshwater mollusca give us in this region from paleolithic times to the present day. Here much that was but doubtful inference before is confirmed, and much that is new added to our knowledge. All this will have important bearings on geological and archæological work throughout Europe.—R. W.

In the November number of the 'Journal of the Marine Biological Association' (vol. xv, pp. 851-874) appear two articles by Dr. J. H. Orton, "Observations on *Patella vulgata*: i. Sex Phenomena, Breeding and Shell Growth. ii. Rate of Growth of Shell." It is concluded that *Patella vulgata* is apparently a protandric hermaphrodite. A preliminary notice is given of investigations into the cause of variation in shell height, wherein it is shown that shell height is determined probably entirely by the degree of exposure of limpets to desiccation in such a manner that the drier the habitat the higher the shell is.

This year the Royal Society Soirée included several exhibits of interest to conchologists. Professor A. E. Boycott, with Captain C. Diver and Dr. F. M. Turner, showed a series of shells illustrating "Inheritance of Coiling and Shell Shape in *Limnaea peregra*" over ten generations. One sinistral 'strain' from a pond near Leeds, when crossed with dextrals, behaved as a mendelian recessive, showing delayed inheritance. But mixed broods also occur, associated with shells more or less coiled on the flat; these reach maturity with difficulty and when fertile give normal progeny. In mixed broods there is a high egg mortality and many embryos become monstrous. Some wild races show an analogous intortion of the spire; one of these when tested has bred true to its shape. The variation of form displayed was remarkable, and isolated shells might well be placed at first sight as *Planorbis*, *Succinea* or *Camptoceras*, while one amazing individual, in preserving the balance between sinistral and dextral pull, has developed a shell of 10 mm. without any torsion at all, a simple conical cap. The investigations are still in progress and the results when published will be of the greatest interest to conchologists and geneticists. At the same soirée Mr. G. C. Robson exhibited a model ($\times 3$) of the remarkable abyssal Cephalopod *Melanotenthis beebeyi* from Cocos Island, in 750 fathoms. The genus *Melanotenthis* is the most primitive group of Octopoda that is known and may be considered as intermediate between that order and the Decapoda. The filamentous appendages between the first and second pairs of arms probably represent a degenerate fifth pair; but they do not represent the decapod tentacles, as these lie between the third and fourth pair of arms. The radular teeth are of a primitive type and resemble those of *Nautilus*. The shell rudiment is well developed. A further exhibit was a scheme showing the evolution of Hoplitid Ammonites, by Dr. L. F. Spath, based upon the morphological and stratigraphical evidence afforded by thousands of specimens, carefully collected bed by bed.—R. W.

The International Congress of Oceanography and Marine Hydrography was held at Seville last May. Originally fixed for March, it was postponed owing to the death of Queen Maria Cristina. Amongst the subjects for discussion were methods for determining the Density of Sea-water, Causes of Ocean Circulation, Co-operation in an international map on the scale of 1/1,000,000, Study of Straits, Modern Methods of determining the Relief of the Sea-bottom.

The following is quoted from the Royal Society's abstracts of papers read on Dec. 6th, 1928:—

A. E. Boycott, F.R.S., C. Diver, S. Hardy and F. M. Turner. The Inheritance of Sinistrality in *Limnæa peregra*.

1. *L. peregra* is normally dextral: a sinistral variety, in which the spiral twist of body and shell is completely reversed, is very rare.

2. Sinistrality behaves as a mendelian recessive, but the appearance of any change of twist imposed by crossing is delayed one generation. Thus a sinistral fertilised by dextral produces (F 1) sinistral young, which (F 2) produce dextral broods: these produce (F 3) dextral and sinistral broods in proportion 3 to 1. Similarly, dextral fertilised by sinistral produces dextrals in F 1 and F 2, and a 3 to 1 mixture of dextral and sinistral broods in F 3.

3. Albinism in this snail is also a simple mendelian recessive and is inherited directly: albino fertilised by pigmented produces pigmented young in F 1, and F 2 consists of broods each containing pigmented and albinos in proportion 3 to 1.

4. It is suggested that the delay in inheritance of sinistrality is due to the twist of animal and shell being determined by the second—probably by the first—division of the egg, which takes place soon after entrance of spermatozoon. Pigmentation and shell-shape not being fixed till later the spermatozoon has more time to bring its influence to bear.

5. This simple scheme of inheritance is interfered with by a tendency for sinistrals to become dextrals (phenotypic or genotypic).

Further details will be found below in the note on exhibits at the Royal Society's Soirée.

The following abstracts from the same source are of particular interest to malacologists.

C. M. Yonge. Structure and Function of the Organs of Feeding and Digestion in the Septibranchs, *Cuspidaria* and *Poromya*. Communicated by Dr. E. J. Allen, F.R.S.:—

The Septibranchs are carnivorous and specialised for taking in and digesting large food particles, which, with water, are drawn in by action of the septum, a highly muscular organ, striated in *Cuspidaria*, but not in *Poromya*. Water passes from the infra-septal cavity into the supra-septal by way of fine pores in *Cuspidaria*, and by two pairs of branchial sieves in *Poromya*. The labial palps are small, ciliated on the inner side, muscular; they push food into the mouth. All cilia in the infra-septal cavity, *i.e.*, on the thickened mantle edges, on the palps, on the foot and lining the pores of the filaments of the branchial sieves, carry particles away from the mouth, either into the supra-septal cavity or to the posterior end of the infra-septal. The oesophagus is wide and muscular, the stomach long and cylindrical, lined throughout with thick cuticle, muscular and free from surrounding tissues; it acts as a gizzard. The digestive diverticula have unusually short and wide ducts and the tubules provide the only absorptive surface in the gut; the style is very small and probably vestigial; the mid-gut and rectum are ciliated; there is a complete absence of wandering phagocytes. All modifications of the gut appear correlated with type of food.

W. J. Dakin. Anatomy and Phylogeny of *Spondylus*, with a particular reference to the Lamellibranch Nervous System. Communicated by E. W. MacBride, F.R.S.:—

An investigation of the bivalve mollusc, *Spondylus*, was undertaken in order to

determine the relationship of this genus to *Pecten*. The desirability for information on this subject arose from the fact that *Spondylus* possesses eyes of a type almost or exactly the same as those of *Pecten*, though the habits of the two genera are very different. *Spondylus* lives fixed by its shell to submerged rocks, etc.; *Pecten* moves about actively and is able to swim.

The investigation indicates that anatomically *Spondylus* is not only a close relative of *Pecten*, but that its structure can be best interpreted by assuming it derived from a form not unlike *Pecten maximus*.

An unexpected discovery was made in the nervous system, which differs remarkably from the type so familiar in all other Lamellibranchs. The pedal ganglia are connected by long nerves to the visceral ganglion and cerebro-pedal connectives are not present as distinct nerves. A theory is provided to explain this nervous system, based on conditions present in *Pecten*. The results of the study are in agreement with palæontological evidence and with information concerning shell development.

W. J. Dakin. The Eyes of *Pecten*, *Spondylus*, *Amussium* and allied Lamellibranchs, with a short Discussion on their Evolution. Communicated by E. W. MacBride, F.R.S. :—

The author has examined the eyes of a series of genera of Lamellibranchs, in order to obtain facts which might help in elucidating the evolution of the eyes of *Pecten*. The eyes of *Pecten*, *Spondylus*, *Amussium*, *Chlamys* and, in all probability, *Pedum* may be considered identical in structure. No Lamellibranchs outside the suborder Pectinacea have eyes of the same type, and within the group the eye structure is remarkably constant, notwithstanding the diversity in the habits of the animals.

The development of the eye throws little or no light upon its evolution. Evidence is brought forward in support of the view that the eyes in the Pectinacea are functionally not so highly developed as their complex structure might lead one to suppose. It is suggested that Internal Factors have played a greater part in their evolution than Natural Selection.

We congratulate the Hon. Secretary very heartily on the degree of D.Sc. just conferred on him by Manchester University. The grounds for this distinction are his researches in geology, zoology, ethnology, prehistoric archæology, etc.



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T H E
JOURNAL OF CONCHOLOGY.

VOL. 18.

DECEMBER, 1929.

No. 12.

MOLLUSCA EATEN BY RABBITS.

BY CHAS. OLDHAM.

(Read before the Society, September 7th, 1929).

WITH Mr. Lawson's account of rabbits feeding on *Helix nemoralis* and *Helix itala* (*ante* pp. 327-8) fresh in my mind it happened that on August 7th I was with Mr. A. W. Stelfox on the coast sand-dunes between Arklow and Mizen Head, in Co. Wicklow. There were many thrush-stones with smashed shells of *Helix aspersa* and *H. nemoralis*, whilst here and there on the sward was an isolated shell of *aspersa* with a large cavity gnawed in one side but with the lip and often the apex of the shell uninjured, a condition indicative of a rodent rather than an avian enemy. In the sand at the mouth of a recently excavated rabbit-burrow were a score of shells of *aspersa* in this state. These had an epiphragm or the remains of one and in several cases two shells were adherent. The evidence suggested that in the dry, hot weather of this summer the snails had æstivated in the sand and had been thrown out by the rabbit, and, perhaps, eaten by it. The sand gave a neutral reaction to a soil indicator, and the shells were very thin; the cavities in them might easily have been gnawed by rats or even mice. Rats are carnivorous creatures and are known to eat terrestrial and aquatic snails of several kinds, but the rabbit is habitually a vegetarian, although it may be that in times of stress, such as a long-continued drought, it adopts snails as an emergency ration; and it must be borne in mind that rabbits were observed by C. E. Wright in the act of eating *nemoralis* in Co. Donegal (*This Journal* xii, p. 268).

Haliotis rufescens Sw. with large Blister Pearls. I have before me a large specimen of this handsome species, which, in order to repel the attacks of what I assume will have been a species of boring sponge that had penetrated the extremely thick shell, has covered with blister pearls the orifices made by the intruder. Seven in all, one blister pearl has a diameter of $\frac{5}{8}$ ", there are three each measuring $\frac{1}{2}$ " and $\frac{3}{8}$ ".—W. GYNGELL.

GARDEN FAUNAS.

By HUGH WATSON, M.A.

(Read before the Society, September 7th, 1929).

IN a recent number of "The Journal of Conchology" A. E. Ellis gave an account of the Molluscan fauna of a garden at Haverfordwest, Pembrokeshire, in which twenty-three species occur.¹ For comparison with the Mollusca of this Welsh garden it may be of interest to give lists of the species that I have found in two, widely separated, English gardens, one in Dorset and the other in Cambridge. Probably the species that occur in all three of these gardens may be looked upon as typical of those that frequent gardens in more or less calcareous districts in the south of Great Britain; while, on the other hand, those that are only found in one of them—such as *Pomatias elegans* at Swanage or *Limax arborum* at Haverfordwest—seem usually to owe their presence there to the fact that they are common members of the wild fauna of the particular district in which that garden is situated.

Both of the following gardens have probably been established for about fifty years, and in each of them all the species were found within an area of about half-an-acre, comprising small lawns, shrubberies, and flower beds, with a little stone-work, etc., partly overgrown with ivy.

(1) "CRAIG-Y-DON," SWANAGE, DORSET.

Altitude above sea, about 180-190 feet; distance from sea, about 100 yards. Geological formation: Purbeck limestone.

<i>Pomatias elegans</i> (Müll.)	<i>Gonyodiscus rotundatus</i> (Müll.)
<i>Ena obscura</i> (Müll.)	<i>Arion hortensis</i> Fér.
<i>Lauria cylindracea</i> (Da Costa)	<i>Vitrea crystallina</i> (Müll.)
<i>Pyramidula rupestris</i> (Drap.)	<i>Oxychilus cellarius</i> (Müll.)
<i>Vallonia costata</i> (Müll.)	<i>Oxychilus draparnaldi</i> (Beck)
<i>Clausilia bidentata</i> (Ström)	<i>Retinella nitidula</i> (Drap.)
<i>Helix hortensis</i> Müll.	<i>Vitrina pellucida</i> (Müll.)
<i>Helix aspersa</i> Müll.	<i>Limax maximus</i> Lin.
<i>Hygromia hispida</i> (Lin.)	<i>Limax flavus</i> Lin.
<i>Hygromia striolata</i> (Pfr.)	<i>Agriolimax agrestis</i> (Lin.)
<i>Helicella virgata</i> (Da Costa)	<i>Milax sowerbii</i> (Fér.)
<i>Helicella caperata</i> (Mont.)	

All the above twenty-three species were found on the afternoon of May 28th, 1928, in the part of the garden to the north of the house. Probably a search extending through other seasons of the year would

¹ "Journal of Conchology," vol. xviii, 1929, p. 312.

yield two or three additional species, perhaps including *Arion ater* (Lin.) or *Oxychilus helveticus* (Blum), forms which are fairly common on the cliffs to the south of the garden.

(2) "BENET HOUSE" (formerly "BRACONDALE"), BROOKLANDS AVENUE, CAMBRIDGE.

Altitude above sea, about 43 feet ; distance from sea about 43 miles. Geological formation : Chalk-Marl (Cenomanian), covered by Pleistocene river gravel.

<i>Cochlicopa lubrica</i> (Müll.)	<i>Helicella virgata</i> (Da Costa)
<i>Lauria cylindracea</i> (Da Costa)	<i>Arion circumscriptus</i> Johnston
<i>Vallonia costata</i> (Müll.)	<i>Arion hortensis</i> Fér.
<i>Vallonia excentrica</i> Sterki	<i>Oxychilus cellarius</i> (Müll.)
<i>Cecilioides acicula</i> (Müll.)	<i>Retinella nitidula</i> (Drap.)
<i>Clausilia bidentata</i> (Ström.)	<i>Vitrina pellucida</i> (Müll.)
and var. <i>tumidula</i> (Jeff.)	<i>Limax maximus</i> Lin.
<i>Helix aspersa</i> Müll.	<i>Limax flavus</i> Lin.
and vars. <i>conoidea</i> Pic., <i>minor</i> Pic., <i>exalbida</i> Moq., etc.	<i>Agriolimax agrestis</i> (Lin.)
<i>Hygromia striolata</i> (Pfr.)	<i>Milax gagates</i> (Drap.)
and vars. <i>depressa</i> (Taylor), <i>minor</i> (Jeff.), <i>albocincta</i> (Ckll.), and <i>alba</i> (Moq.)	<i>Milax sowerbii</i> (Fér.)
	And in greenhouse only, <i>Oxychilus alliarius</i> (Miller)

The above list of twenty species is the result of several years' intermittent collecting and is therefore likely to be nearly complete. *Hygromia striolata* is the most abundant species in this garden, but on warm, damp evenings numerous specimens of *Helix aspersa* may also be seen: I once counted twenty on a young laburnum, upon which they seemed to be feeding. Only dead shells of *Cecilioides acicula* and *Helicella virgata* were found, and these species may not now live within the garden, although *H. virgata* occurs in the immediate vicinity. On the other hand, some of the following additional species are not unlikely to be found in this garden sooner or later, since they all occur, with several of the above-mentioned forms, under similar conditions in the neighbouring Botanic Gardens.

<i>Ena obscura</i> (Müll.)	<i>Gonyodiscus rotundatus</i> (Müll.)
<i>Testacella haliotideia</i> Drap.	<i>Vitrea crystallina</i> (Müll.)
<i>Helix nemoralis</i> Lin.	<i>Oxychilus draparnaldi</i> (Beck)
<i>Hygromia hispida</i> (Lin.)	

The last of these species lives not only in the open air, but also in the hot-houses of the Botanic Gardens, where the following exotic species of land Mollusca also occur.

<i>Opeas goodallii</i> (Miller)	<i>Pseudovitrea minuscula</i> (Binney)
<i>Opeas urichi</i> (Smith)	<i>Zonitoides arboreus</i> (Say)
<i>Helicodiscus parallelus</i> (Say)	

ADDITIONAL NOTES ON THE LAND AND FRESHWATER
MOLLUSCA OF SUSSEX.

By J. GORDON DALGLIESH, F.L.S.

(Read before the Society, September 7th, 1929).

Cepæa hortensis Müll. var. **nigrolabiata** Taylor.

A small *incarnata* form, which at first was thought to be *nemoralis* with the usual black aperture and lip, was taken at West Blatchington in June, 1929. An examination of the gypsobelum revealed *hortensis*.

Planorbis corneus Linn. var. **rubra** Oldham.

On June 1st, 1929, in company with Mr. A. G. Stubbs, I took several specimens of this variety from a marsh drain at Lewes. The living animal is blood-red, and in bright sunshine the shell appears golden, hence the popular name amongst aquarists of "golden water-snail" is very appropriate. According to Oldham (Proc. Mal. Soc., vol. xviii, pt. 1, pp. 42-4, April, 1928), the variety is rare in this country, though known since 1878, and has hitherto been recorded from Leeds, near Hull, and from a pond at Barnet, Herts.

Bithynia tentaculata L. var. **excavata** Jeff.

Taken in a marsh drain at Henfield.

Pomatias elegans Müll. var. **fasciata** Picard.

Bepton Hangar, near Midhurst.

Aplecta hypnorum Linn.

Borrer recorded this species in 1860 from Sayer's Common, now drained, and Henfield Common, and there are specimens from this last locality in the Brighton Museum. Diligent search had hitherto failed to find any at Henfield. But on May 31st, 1929, in company with Mr. A. G. Stubbs, several specimens were taken from an almost dry marsh drain there.

Segmentina nitida Müll.

Very abundant and particularly fine in a very muddy ditch at Lewes on June 1st, 1929.

Anodonta anatina Linn. var. **complanata** Rossm.

Specimens approaching this form were taken from the river Adur at Henfield by Mr. P. Arnold.

Sphærium corneum Linn. var. **nucleus** Studer.

Taken from a marsh drain at Henfield on May 31st, 1929, by Mr. A. G. Stubbs.

Pisidium amnicum Müll.

Three specimens were taken from a marsh drain at Henfield in May, 1929, a very unusual situation, as this species has a decided preference for clearer running water. Mr. A. G. Stubbs informs me that it is invariably associated with the common horse-leach.

The following **Pisidia** have been identified by Mr. C. Oldham :—

Pisidium casertanum Poli. Lewes.

Pisidium nitidum Jenyns. Lewes.

Pisidium subtruncatum Malm. Henfield and Lewes Levels.

Pisidium milium Held. Henfield and Upper Dicker.



PROCEEDINGS OF THE
CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND.

575th Meeting, held at the Manchester Museum, September 7th, 1929.

Mr. G. C. Spence in the chair.

Member Deceased.

E. F. Wesley.

Candidates Proposed for Membership.

Hans Leo Dabbert, Knesebeckstrasse 76, Charlottenburg, near Berlin, Germany (introduced by H. Schlesch and W. T. Elliott).

Noel Brydie Davis, Red Lodge, Tadworth, Surrey (introduced by C. P. Richards and Henry Coates).

Hans Modell, Assessor, Neues Justizgebäude, Munich 35, Bavaria (introduced by H. Schlesch and W. T. Elliott).

Papers Read.

“Additional Notes on the Land and Freshwater Mollusca of Sussex,” by J. G. Dalgliesh.

“Land Mollusca of Lugano,” by Dr. F. F. Laidlaw.

“Garden Faunas,” by Hugh Watson.

“Mollusca eaten by Rabbits,” by Chas. Oldham.

Exhibits.

By Mr. G. C. Spence :—Several new Urocoptids.

By Mr. C. H. Moore :—*Thecalia concamerata* Brug. from Natal.

By Dr. J. W. Jackson :—A curious double-banded form of *Limnaea pereger* from Derwentwater, collected by Mr. H. Britten.

THE HABITAT OF *CLAUSILIA BIPLICATA* Mont.

By A. E. BOYCOTT.

(Read before the Society, Nov. 6th, 1929).

THERE seems to be a general impression that the characteristic habitat of *Clausilia biplicata* is a damp or marshy place near a river and that it has a special association with willow trees. The facts hardly bear this out.

In his original description of the species, Montagu¹ says "we first discovered this species sparingly at Easton Grey in Wiltshire, and many years afterwards observed it in the cabinets of Mr. Swainson and Mr. Sowerby in London, by whom we are informed it was not uncommon in the neighbourhood of the metropolis, especially in Hyde Park." He gives no further particulars: Easton Grey (three miles west of Malmesbury and nearly in Gloucestershire) is a civilised place; there is a river and woods and plantations, hedge banks and stone walls. Gray² says "woods and close hedges"; Dixon and Watson³ "woods and hedges near London; probably confined to the chalk districts"; Jeffreys⁴ "at the roots and in the bark of old willow-trees . . . banks of the Thames near London"; Reeve⁵ "in woods and hedges, among the roots of shrubs; banks of the Thames near London"; Harting⁶ "on the banks of the Thames near London"; Rimmer⁷ "at the roots and on the bark of willow trees, and among moss on banks"; Williams⁸ "woods and hedges, and on the bark of willow trees"; Adams⁹ "at the roots and on the bark of willows by the Thames"; Swanton¹⁰ "woods and hedges; under the large osiers by the Thames at Hammersmith"; Ellis¹¹ "amongst herbage and on willows by rivers, and on chalky banks." Abroad, Moquin-Tandon¹² says for France "under moss," Geyer¹³ for Germany "on walls and trees, in woods and thickets" and Steenberg¹⁴ for Denmark "in woods and gardens, among leaves and stalks, rarely high up on trunks, under bark, in tree stumps, on old walls and under stones."

1 *Testacea Britannica* 1803, p. 361.

2 *Turton's Manual* 1840, p. 214; 1857, p. 184.

3 *British Land and Freshwater Shells* 1858 p. 53.

4 *British Conchology* 1862, vol. i, p. 283.

5 *Land and Freshwater Mollusks* 1863, p. 102.

6 *Rambles in search of Shells* 1875, p. 66.

7 *Land and Freshwater Shells* 1880, p. 175.

8 *Shell-Collector's Handbook* 1888, p. 137.

9 *Manual* ed. 2, 1896, p. 107.

10 *Pocket Guide to the British Non-Marine Mollusca* 1906, p. 70.

11 *British Snails* 1926, p. 185.

12 *Hist. Nat.* 1855, vol. ii, p. 338.

13 *Unsere Land-und Süßwasser-Mollusken* ed. 3, 1927, p. 103.

14 *Danmarks Fauna: Landsnegle* 1911, p. 137.

There are at the present time three known localities in England for *Cl. biplicata*: I have been able to visit them on several occasions during the last ten years.

(1) BARNES and the neighbourhood (Chiswick, Mortlake), partly in Surrey and partly in Kent. This area is no doubt what remains of the "very common in several places near London" of Gray's experience¹, and it seems pretty clear that the species has been known to exist in one or another place near the Thames between the West End of London and Kew for about 130 years. Adams and Rimmer mention Putney and Hammersmith² but the progressive urbanisation of recent years seems to have led to its disappearance in those places though it has been collected,³ and may still be taken abundantly, three or four miles further upstream. I am familiar with two loci and no doubt the species lives elsewhere in the neighbourhood.

(a) A very ordinary hedge bank, 120 yards from the river, with a scanty vegetation of grass and nettles, a thorn hedge with a few elm trees, bordering a much-used footpath from the towing-path above Mortlake to Kew.

(b) An artificial bank in some market gardens on the north side of the river close to Barnes bridge. The land near the river has been artificially raised and the bank is formed where, 250 yards from the river, this new ground slopes down to the natural level. The species may also be found on the neighbouring railway embankment. The bank is made of earth, stones, rubbish of various kinds and has an abundant vegetation, nettles, hop and *Ballota nigra* being predominant with *Lamium album*, horseradish, *Artemisia vulgaris*, *Solanum dulcamara*, *Arctium lappa*, etc. and a few plants of the Peruvian alien *Galinsoga parviflora*. There were originally three small willow bushes but I never saw *biplicata* on them. Garden and other rubbish is thrown freely on the bank—old tins, oyster shells, rhubarb roots and the like. There are plenty of other mollusca: *Limax maximus*, *Agriolimax agrestis*, *Arion hortensis*, *A. circumscriptus*, *Hyalinia lucida*, *Hy. cellaria*, *Hy. nitidula*, *Goniodiscus rotundatus*, *Trichia striolata*, *Theba cantiana*, *Cepæa hortensis*, *Vallonia excentrica*, *Cochlicopa lubrica*. The locus as a whole is dry—in dry weather very dry—the soil is calcareous and fizzles freely with acid, and the general conditions are highly sophisticated and civilised. *Cl. biplicata* is found on the ground, under stones and blocks of concrete and crawling among the plants. It is as abundant in 1929 as it was in 1919.

¹ Turton's *Manual* 1840, p. 37.

² Mr. J. W. Taylor (*Journ. Conch.* 1877 vol. i, p. 216) collected it in 1866 "at Hammersmith, from the trunks of the willow trees."

³ e.g. by F. B. Jennings (*Journ. Conch.* 1912, vol. xiii, p. 354) who notices that it had no association with willows.

(2) PURFLEET (Essex), a locus discovered (perhaps re-discovered¹) by F. B. Jennings in 1919. It may be collected here off the up platform of the railway station (300 yards from the river) and occurs on chalky banks close by and in the entrance to an old chalk pit immediately to the north-west of the road leading into the station. The ground is dry and *biplicata* lives on the ground among ivy and *Clematis* with nettles and some grass: part of the locus is rather deeply shaded with thorn bushes and *biplicata* seems to prefer the more open parts. With it are found *Limax maximus*, *Hyalinia cellaria*, *Hy. nitidula*, *Vitrina pellucida*, *Goniodiscus rotundatus*, *Theba cantiana*, *Trichia hispida*,² *Helix aspersa*, *Cepæa nemoralis*, *C. hortensis*, *Ena obscura*, *Cochlicopa lubrica*, *Clausilia laminata*³ with white-shelled forms of *biplicata*, *laminata* and *hispida*.

(3) CAMBRIDGE.⁴ Mr. Hugh Watson was good enough to show me where the species lives here on a frequented island in the Cam. There are a number of willow trees, old and young, up which *biplicata* climbs after heavy rain: otherwise it lives on the ground which is highly calcareous: the vegetation is mostly nettles, willow herb and goose grass. *Trichia striolata*, *Arianta arbustorum*, *Clausilia rugosa*, *Cochlicopa lubrica*, and *Succinea putris* are the most abundant associates with *Trichia hispida* and *Hyalinia alliaria* and many dead shells of *Limnæa* and *Planorbis* show that the place is sometimes flooded.

None of these three localities can be called "wild" and those at Barnes and Purfleet are highly humanised. Two of them are distinctly dry; The Cambridge locus is often wet, but with the river running at its normal level the ground is not at all marshy. All three are calcareous. The Purfleet and Cambridge loci are decidedly circumscribed and the species cannot be found outside of the small area in which it is abundant.

Taking these facts and opinions together it seems that the idea that *biplicata* likes wet places is an unjustified inference from the traditional habitat "on willow trees by the Thames at Hammersmith."⁵ The three current loci are all more or less artificial in character and, beyond suggesting the desirability of calcareous soil, do not help us much to define the natural habitat of the species. The snail has no particular connection with willow trees and it is essentially geophilic

¹ *J. Conch.*, 1921, vol. xvi. p. 144. Mr. A. S. Kennard has specimens from Purfleet collected by W. Whitaker in 1870.

² *Trichia striolata* as well as *Cyclostoma elegans* appear to be absent from the riverside chalk in South Essex where the exposures of chalk are perhaps all due to human agencies: they are both common across the river in Kent.

³ The only place in which I have taken *Cl. laminata* without *Cl. rugosa*.

⁴ "Cambridge" is given by J. G. Jeffreys *Brit. Conch.* 1859, vol. v, p. 161.

⁵ Made use of in a detective story by Dr. R. A. Freeman (*Pearson's Magazine* 1922, vol. liii, p. 379) when the villain is convicted of having been along the river bank at Hammersmith by the discovery of a *biplicata* in some grass he had pulled up.

though not perhaps to the same extent as *Cl. rolphii*. Its viviparous habit implies that it lives generally in dry places as do our other viviparous species (*Pupa umbilicata*, *P. marginata*, *Pyramidula rupestris*, *Balea perversa*). I do not know of any particularised record for "woods" which are frequently mentioned in the older books.

It is most desirable that search should be made for the species in uncivilised places: it does not appear to have been found for many years outside the three localities I have dealt with. Mr. A. S. Kennard has specimens from "Plaistow Marshes" and "Deptford Creek"¹ (which nowadays are not very wild) and from "Tring Park, Herts., W. Whitaker, 1870" which becomes a possible place once the idea of hygrophily is given up. The Norman collection contained specimens from "Herts (Pickering)"². Several of the older books mention Bristol, apparently on the authority of Miller. In Wiltshire, besides Easton Grey, it has been recorded for Alderbury and Clarendon, Roundway and Devizes, and Durnford.³ In Surrey a single immature specimen was recorded from near Haslemere in 1901;⁴ shells exist in Haslemere Museum said to have been collected in 1848 by F. Townsend at Leckhampton near Cheltenham.⁵ In Somerset⁶ it has been recorded for Winscombe (1865). As a fossil it is very rare in England: Mr. Kennard has been good enough to tell me that he has records from Fulham, Blackfriars, Reigate, Walton Heath and Kingston Camp in Somerset, the last of which is particularly interesting. In some of these districts it probably still exists; it would be strange if it has disappeared from its wild localities and persisted in "civilised" places. Where to look for it I do not know; perhaps chalky hedge banks are most likely. It is clear at any rate that attention should not be restricted to willow trees by rivers.



¹ *Journ. Conch.* 1929, vol. xviii, p. 277.

² B. B. Woodward, *Proc. Mal. Soc. Lond.* 1902, vol. v, p. 11; C. Oldham *Trans. Herts. Nat. Hist. Soc.* 1913, vol. xv, p. 20. The record for Digswell (*ib.* 1894, vol. vii, p. 50) is presumably a *lapsus calami*.

³ E. W. Swanton, *Journ. Conch.* 1908, vol. xii, p. 181. I have visited Easton Grey and Durnford (twice) in vain.

⁴ C. Pannell, *Journ. Conch.* 1902, vol. x, p. 174.

⁵ *Journ. Conch.* 1913, vol. xiv, p. 57.

⁶ E. W. Swanton, *Mollusca of Somerset* 1912, p. 43. Mr. Swanton doubts this record and also that from Haslemere; repeated searches have brought no more to light.

LAND MOLLUSCA OF LUGANO.

BY DR. F. F. LAIDLAW.

(Read before the Society, September 7th, 1929).

A WEEK spent in and about Lugano last May gave me a welcome opportunity of getting to know a little of the snail fauna of a part of the world quite new to me.

I have not been able to find any recent account of the snails of that district. I owe to Dr. Wilfrid Jackson an opportunity of studying Stabile's *Fauna Elvetica—Delle Conchiglie terrestri e fluviali del Luganese*, published in 1845; I regret I have not been able to see his later list (*Prospetto sist-statist. Moll. terr. e fluv. Lugano*, 1859).

It will be seen that the fauna is a very interesting one. I was surprised to find that the *Helicella* section of the Helicidæ is so feebly represented, and that *Otala* and its immediate allies are entirely absent.

I was a little disappointed not to find *Drepanostoma nautiliforme*, it is probably quite local in distribution. Stabile says it is found in damp, shady places on mica-schist in company with *Helix rotundata*, *H. obvoluta*, *Pupa ferrari*, etc.

HELICIDÆ

***Helix pomatia* L.**

Abundant about Lugano and in the district. Numerous examples were seen pairing. I saw specimens at a height of over 1500 metres on Mte. Generoso under rocks which had a fortnight before been under snow.

Major Grant tells me that the snail is eaten by the people of San Mamete, and its shell used as a little lamp at a 'festa.'

***Cepæa nemoralis* L.**

Fairly common, especially on the roadside near Melide.

***Helicigona cingulata* Studer.**

Helix cingulata Stabile, op. cit., 1845, p. 25.

A large colony of this handsome snail was found on damp, shady rocks just above the church of the little Italian village of San Mamete on the lake. They are active creatures, their black bodies contrasting with the white, flattened shell. The rock was deeply fissured and in the fissures numbers of the snails could be seen, the shape of the shell evidently allowing them to crawl freely in very restricted space.

Stabile remarks that the species is abundant on S. Salvatore.

Helicigona cisalpina Stabile.

Helix foetens Studer, Stabile, op. cit., 1845, pp. 28-29.

Near the summit of Monte Generoso. One dead adult; several quite young seen under rocks on which snow was still lying.

Helicodonta angigyra Ziegler.

Helix angigyra, Stabile, op. cit., 1845, p. 27.

Common in wooded places all around the lake.

Theba strigella (Drap.).

Helix strigella, Stabile, op. cit., 1845, pp. 25-26.

Dead shells amongst débris at the base of rocks, near the village of Bre.

Theba cartusiana (Müll.).

Helix carthusianella Drap., Stabile, op. cit., 1835, p. 24.

Very small specimen near Paradiso, Lugano; diam. max. 8 mm., alt. 5.5 mm.

Hygromia incarnata (Müll.).

Helix incarnata, Stabile, op. cit., 1845, p. 23.

Hygromia limbata (Drap.).

Not recorded by Stabile (1845) but fairly common in woods on road to Melide.

Trichia striolata (Pfr.).

Helix striolata, Stabile, op. cit., 1845, pp. 25-26.

Ciliella ciliata (Venetz).

Helix ciliata, Stabile, op. cit., 1845, p. 32.

Common under dead leaves in wooded places round the lake at low levels.

Helicella candidula (Studer).

Helix candidula, Stabile, op. cit., 1845, pp. 24-25.

A few individuals near Bre.

PUPILLIDÆ.

Abida frumentum (Drap.).

Torquilla triticum Ziegler, Stabile, op. cit., p. 40.

Taken at Gandria, Bre and San Mamete.

Abida secale (Drap.). Two of var. *minor* from Monte Generoso.

Chondrina megacheilos (C. & J.).

Torquilla avena (Drap.). var. (a) *parva*, var. (b) *media*, Stabile, op. cit. pp. 40-41.

See also Pilsbry Man. Conch. (2) xxvii, p. 213.

Abundant on limestone rocks near Gandria, where I found specimens of both forms *parva* and *media*.

Pagodulina pagodula (Des Moulins).

Pupa pagodula, Stabile, op. cit., 1845, p. 36.

A single example from near Gandria.

Agardhia ferrari (Porro).

Pupa ferrari, Stabile, op. cit., 1845, p. 35.

Six specimens amongst boulders and fallen leaves near the top of Monte San Salvatore.

ENIDÆ.

Ena obscura (Müller).

Bulimus obscurus, Stabile, op. cit., 1845, p. 35.

A single specimen found on the roadside amongst shrubby herbage near Lago di Muzzano.

Chondrula tridens (Müller).

Torquilla tridens, Stabile, op. cit., 1845, pp. 38-39.

One example taken in a wood near Lago di Muzzano.

Chondrula quadridens (Müll.).

Torquilla quadridens, Stabile, op. cit., 1845, p. 39.

Gandria. San Mamete. A few specimens, mostly dead.

CLAUSILIIDÆ.

Clausilia itala Martens.

Clausilia albopustulata Jan, Stabile, op. cit., 1845, pp. 41-42.

Bre, and on rocks along the road to Melide.

Clausilia plicata Drap.

Bre, several specimens amongst rocks.

Clausilia lineolata Held. Two near the village of Bre.

Clausilia rugosa Drap.?

Monte Generoso, 1200 m. These specimens agree very closely with the figure of the form identified as *rugosa* by Stabile. I am not sufficiently expert to say whether the identification is correct.

ENDODONTIDÆ.

Goniodiscus rotundatus (Müll.).

Helix rotundata, Stabile, op. cit., 1845, p. 27.

Collected near Gandria, and near Melide on old walls.

ZONITIDÆ.

Retinella sp.

This species agrees in size with that recorded by Stabile as *H. cellaria* Müll., greatest breadth 14 mm., alt. 3 mm. I am not sure what the species is; it is certainly not the same as the British *cellaria*. Common on an old wall near Drano.

CYCLOPHORIDÆ.

Cochlostoma septemspirale (Raz.).

Pomatias maculatum Drap., Stabile, op. cit., 1845, p. 44.

Common at Gandria, San Mamete and Bre on limestone rocks. Taken also on Monte Generoso at a level of about 1000 metres.

Below I append a list of species recorded by Stabile (op. cit. 1845) which were not noted by me.

Vitrina elongata Drap.**Helicodonta obvoluta** (Müll.).

Helix obvoluta Stabile, op. cit., 1845, pp. 26-27.

Vallonia pulchella (Müll.).

Helix pulchella, Stabile, op. cit., 1845, p. 29.

Vitrea crystallina (Müll.).

Helix crystallina, Stabile, op. cit., 1845, pp. 29-30.

Oxychilus lucidus (Drap.).

Helix lucida, Stabile, op. cit., 1845, p. 50.

Pyramidula rupestris (Drap.).

Helix rupestris, Stabile, op. cit., 1845, p. 31.

Acanthinula aculeata (Müll.).

Helix aculeata, Stabile, op. cit., 1845, p. 31.

Petasiella unidentata (Drap.).

Helix monodon, Stabile, op. cit., 1845, p. 33.

Drepanostoma nautiliforme Porro.**Cochlicopa lubrica** (Müll.).

Columna lubrica, Stabile, op. cit., 1845, p. 34.

Lauria sempronii Charp. var. *dilucida* Zgl.

Pupa dilucida Ziegler, Stabile, op. cit., 1845, p. 36.

Vertigo pygmæa (Drap.).**Vertigo pusilla** (Müll.).**Columella edentula** (Drap.).

Vertigo edentula Studer, Stabile, op. cit., 1845, p. 37.

Truncatellina cylindrica (Fér.).

Vertigo minutissima Hartmann, Stabile, op. cit., 1845, p. 38.

Balea perversa Müll.

Balea fragilis Drap., Stabile, op. cit. 1845, p. 41.

Clausilia sp.

Tumida mihi, Stabile, op. cit., 1845, pp. 43-44.

Carychium minimum (Müll.).

Carychium tridentatum Risso.

C. elongata Villa (Stabile).

Succinea oblonga Drap.



EDITORIAL NOTES.

THE Annual Meeting was held at the Manchester Museum on Oct. 19, and Major M. Connolly was elected President for 1929-30. The other Officers and all the Council were re-elected. The retiring President gave an Address on "The British Anodontas."

It is with the very greatest regret that we record the death of one of our oldest members, Dr. J. Cosmo Melvill, on Monday, Nov. 4th, at the age of 84. The news only came whilst this number was in the press.

Interesting particulars of the larvæ of some of the Trematode Worms parasitic on Freshwater Mollusca in Scotland are given by Dr. W. F. Harper in *Parasitology* xxi, 1929, p. 189

In the *Journ. Marine Biol. Association* (Plymouth) xvi, No. 1, May, 1929, A. C. Stephen gives detailed results of the study of the Rate of Growth of *Tellina tenuis* da Costa in the Firth of Clyde. Two of the points established are that there is no growth in the winter months, and that the rate of growth at low water mark is less than near high water mark.

"The Glorious Oyster" by Hector Bolitho, with certain chapters edited by Maurice Burton, M.Sc., of the Natural History Museum, London, 1929; Alfred A. Knopf, London and New York. A very comprehensive popular monograph from the historical, zoological, literary and gastronomic points of view, and including chapters on the enemies of oysters and on oyster culture.

The Peking Society of Natural History has commenced the issue of a series of handbooks, and No. 2 is an interesting and useful account in 252 pages of "The Shells of Peitaiho" by A. W. Grabau and Sohtsu G. King, the junior author being a member of our Society. It is illustrated with eleven photographic plates. In addition to the excellently annotated systematic list, there are chapters on collecting, and on the "chief characters of the Pelecypod and Gastropod shells." Many new species are described. We heartily welcome the first faunal volume that has been published for any part of China.

Mr. W. Gyngell tells me, à propos of the introduction of *Helix pomatia* into Forge Valley, near Scarborough, in 1868 (J. of C. xii, p. 303), that in the Bean collection there is a specimen of *H. lucorum* Müller labelled "found alive in Forge Valley," but no *H. pomatia* so labelled.

A Monograph of the Recent Cephalopoda, based on the Collections in the British Museum (Natural History). Part I—Octopodinae. By G. C. Robson, M.A., London, 1929, 236 pages, 7 plates and numerous text-figures. Price 17/6.

This is a book which it is a pleasure to notice : to say that it is a brilliant piece of work is to do it less than justice, for it is obviously the product of prolonged study, detailed care and much reflection. Scholarship, knowledge and a wide outlook we expect from Mr. Robson : but we could hardly expect him even with his experience to bring so much order into this chaotic group. The special difficulties which face the systematist working on Octopus include a liability to distortion which renders most external characters and measurements of little value, the small

number of specimens usually available, the inadequacy of descriptions in literature and the very great individual variation in Octopods (see pp. 3, 4). The group appears to be in an active evolutionary stage and the author points out that intensive studies on the variation of single species are much needed. Here, indeed, lies one value of a systematic study of Octopods to the general biologist: and an analysis of variation in *Octopus vulgaris* Lamarck forms the subject of chapter 5 of this work. This aspect of the subject has been kept in view throughout and the author has been at pains to study material available in Edinburgh, Paris, Berlin, Leipzig, Jena, Frankfurt, Leiden and Washington as well as in the British Museum, which, naturally, much increases the authenticity and value of the book. The work is cast in a form that will be eminently useful to other workers; I particularly commend the chapter on phylogeny and the table of measurements (pp. 42-55). Of 102 forms here listed 87 are referred to *Octopus* and its subgenera, while only 15 display special features requiring removal to seven other genera; but certain other species as *Bathypolypus arcticus* (Prosch), *Benthoctopus piscatorum* (Verrill) which are commonly referred to *Octopus* and conveniently listed on p. 40, are removed to a separate subfamily Bathypolypodinae, which with the Eledoninae is to be discussed in part II of this work. The erratic variation and the absence of any fossil evidence make it difficult to recognize evolutionary tendencies: Mr. Robson, however, gives some interesting considerations, discussing the arms, the webs, the funnel organ, the gills, the hectocotylus, the radula, the inksac and the mantle aperture from this aspect, concluding that *Octopus sensu stricto* is the most primitive group; and while the complete array of characters assumed to be primitive is not found in any one species, *O. defilippi* Verrany presents the nearest approximation to this condition. Some interesting facts of geographical distribution are brought out; the Magellanic and North Pacific Regions seem to be foci of local differentiation, giving rise to fairly distinctive groups, while the rest of the world is occupied by a population in which peculiar faunas are difficult to distinguish and the individual range of species is wide; thus, after discounting dubious records, *Octopus vulgaris* and *O. macropus* are found to range from the Mediterranean to Japan; and *O. rugosus* is world-wide in tropical waters.

In the systematic part which occupies the bulk of the work the arrangement is good and clearly the most has been made out of the material; by some slip the arrangement of species in the systematic part and in the table of species differ in some small particulars: the references seem to have been carefully checked and I have found no errors here as far as I have tested them; the few misprints that I have noticed are unimportant and obvious, such as Russel for Russell (p. 40) and specie for species (p. 131). The format of the book is worthy of the institution it comes from. In the preface we read, "as in many other groups of animals, the description of 'new species' has gone on without any critical revision of the species supposed to be 'known.' Much of the obscurity that has thus arisen still defies and will probably always defy elucidation. Meanwhile it is hoped that the revision here attempted will facilitate future study of the group." This hope, I feel sure, will prove amply justified.—R.W.

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